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SAM II Measurements of the Polar Stratospheric Aerosol

Volume VIII—April 1982 to October 1982

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and David Brandl

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SAM II Measurements of the Polar Stratospheric Aerosol

Volume VIII—April 1982 to October 1982

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Scientific and Technical Information Branch

PREFACE

This is the eighth in a series of reports presenting results obtained from the Stratospheric Aerosol Measurement (SAM) II sensor aboard the Nimbus 7 spacecraft. The first 6 months of data were previously reported by McCormick in NASA Reference Publication 1081 entitled "SAM II Measurements of the Polar Stratospheric Aerosol, Volume I - October 1978 to April 1979." Similarly, the second 6 months of data, covering April 1979 to October 1979, were published in NASA Reference Publication 1088, and the third, fourth, fifth, sixth, and seventh 6 months of data were reported in NASA Reference Publications 1106, 1107, 1140, 1141, and 1164, respectively. Each report contains selected data products such as aerosol extinction profiles, aerosol extinction isopleths, temperature contours, and optical depths associated with 6 months of observations. The satellite was launched in late October 1978 and is still providing high-quality data. This report includes data from April 1982 to October 1982. It is intended for future reports to cover subsequent consecutive 6-month time periods.

All the SAM II data and data products are being archived on magnetic tape at the National Space Sciences Data Center, NASA Goddard Space Flight Center, Greenbelt, Maryland 20771, and are available to interested researchers. Because of the large volume of data retrieved by the SAM II system, it is impossible to present all the results in hard-copy form. Consequently, this series of reports is intended to give, in a ready-to-use visual format, an overview of the data products being archived. It contains a large enough sampling of the results to allow for any analysis not requiring the entire data base. No attempt has been made in this report, however, to provide any scientific analysis with the data set. Some investigations have been already initiated by the SAM II Science Team, which is made up of the following people: G. W. Grams, Georgia Institute of Technology; B. M. Herman, University of Arizona; T. J. Pepin, University of Wyoming; P. B. Russell, NASA Ames Research Center; and M. P. McCormick, NASA Langley Research Center.

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SUMMARY

The Stratospheric Aerosol Measurement (SAM) II sensor is flying aboard the Earth-orbiting Nimbus 7 spacecraft, providing extinction measurements of the Antarctic and Arctic stratospheric aerosols with a vertical resolution of 1 km. This report presents representative examples and weekly averages of these aerosol data as well as corresponding temperature profiles provided by the National Meteorological Center of the National Oceanic and Atmospheric Administration (NOAA) for the time and place of each SAM II measurement during the eighth 6 months of satellite flight, April 1982 to October 1982. From the aerosol extinction-profile data, contours of aerosol extinction as a function of altitude and longitude or time are plotted. Also, aerosol optical depths are calculated for each week. Seasonal variations and variations in space (altitude and longitude) for both polar regions are easily seen. Typical values of aerosol extinction at the SAM II wavelength of 1.0 µm in the main stratospheric aerosol layer are approximately 4 to 6 times 10^{-4} km^{-1} at the beginning to 1 to 2 times 10^{-3} km^{-1} at the end of the time period for the Southern Hemisphere and approximately 1 to 3 times 10^{-3} km^{-1} for the Northern Hemisphere throughout the time period. Optical depths for the stratosphere are about 0.002 to 0.009 for the Antarctic region throughout the time period and about 0.007 at the beginning to 0.024 at the end of the time period for the Arctic region. The Arctic values are much larger than the background values of 1978 to 1979 because of the injection of aerosols into the stratosphere by the eruptions of Alaid (Apr. 1981), of an unknown volcano (Dec. 1981 to Jan. 1982), and of El Chichon (Mar. to Apr. 1982). The Antarctic values are also elevated over the background values of 1978 to 1979 but to a much lesser amount. Polar stratospheric clouds (PSC's) at altitudes between the tropopause and 20 km were observed during the Antarctic winter at various times and locations, as expected. No attempt has been made in this report to give any detailed explanations or interpretations of these data. The intent of this report is to provide, in a ready-to-use format, a representative sample of the eighth 6 months of data to be used in atmospheric and climatic studies.

INTRODUCTION

The SAM II sensor is aboard the Earth-orbiting Nimbus 7 spacecraft and is designed to measure solar irradiances that have been attenuated by aerosol particles in the Arctic and Antarctic stratosphere. A principal goal of this mission is to map these polar aerosol layers and to generate a long-term data base or aerosol climatology. This data base will allow for studies of aerosol changes due to seasonal and short-term meteorological variations, atmospheric chemistry and microphysics, and volcanic activity and other perturbations. The results obtained will be useful in a number of applications, particularly the evaluation of any potential climate effect caused by stratospheric aerosols. References 1 to 8 are examples of papers which rely on SAM II data.

SAM II INSTRUMENT

The SAM II instrument consists of a single-channel Sun photometer with a 0.04-µm passband centered at a wavelength of 1.0 µm. This is a region of the spectrum where absorption by atmospheric gases is negligible; consequently, any extinction is due to scattering by aerosol particles and air molecules.

In operation, the instrument is activated shortly before each sunrise or sunset encountered by the satellite. A sensor with a wide field of view is used to indicate the Sun's presence. Two similar sensors then point the SAM II to within ±0.03° in azimuth (left and right). A mirror begins a rapid vertical scan until the Sun image is acquired by the SAM II telescope. The mirror then slowly scans vertically across the Sun at a rate of 0.25 degree per second reversing itself each time a Sun-limb crossing occurs. The entrance window to the SAM II telescope only passes sunlight of wavelength greater than 0.9 μm. A circular aperture placed at the image plane serves to define the instrument's instantaneous field of view to be 0.5 minute of arc. This corresponds to a vertical resolution in the atmosphere of approximately 0.5 km altitude. From the telescope the light is directed through an interference filter, which rejects all but the 1.0-μm-wavelength (±0.02 μm) passband, to a photodiode detector. Light intensity as a function of time is digitized, recorded, and telemetered back to Earth. These data are reduced to yield the transmissivity of the atmosphere as a function of altitude and then inverted to give the extinction coefficient as a function of altitude (extinction profile). The inversion procedures used are described in Chu and McCormick (ref. 9).

A description of the SAM II instrument, and of the experiment in general, is given by McCormick et al. (ref. 10). Further descriptive and technical details are found in Russell et al. (ref. 11) and The Nimbus 7 User's Guide (ref. 12).

THE NIMBUS 7 SATELLITE ORBIT AND SAM II MEASUREMENTS

The SAM II instrument, along with a number of other sensors, is mounted on the Nimbus 7 Earth-orbiting satellite. The orbital characteristics of this satellite determine the measurement opportunities and geographic locations of the SAM II measurements. Recall that the mode of operation of the instrument is such that it takes data during each sunrise and sunset encountered. The Nimbus 7 satellite has an orbital period of 104 minutes, which means that it circles the Earth nearly 14 times per day. Each time the satellite enters into or emerges from the Earth's shadow, there is a measurement opportunity for the SAM II. Consequently, the instrument takes data during approximately 14 sunrises and 14 sunsets each Earth day. The orbit of the satellite is a high-noon, Sun-synchronous one; that is, each time the satellite crosses the Equator, the center of the Earth, the satellite, and the center of the Sun all fall along a straight line. In general terms, this means that the orbital plane of the satellite is fixed with respect to the Sun and that all sunsets occur in the Arctic region whereas all sunrises occur in the Antarctic region. In the course of a single day, measurements of the stratospheric aerosol will be obtained at 14 points spaced 26° apart in longitude in the Arctic region and similarly for the Antarctic region. All the points obtained during 1 day in a given region will be at very nearly the same latitude, but as time progresses, the latitude of the measurements will slowly change with the season by 1° to 2° each week, gradually sweeping out the area from 64° to 80°. Figure 1 shows this latitudinal coverage for the period covered by this report. Lowest latitude coverage occurs at the solstices whereas the highest latitudes are measured at the equinoxes.

In the course of 1 week, therefore, the instrument makes about 98 measurements in each region, all in a band of latitude of approximately 1°. These measurements give a fairly dense set of data points. When the locations of all the measurements obtained in 1 week are plotted on a geographic set of axes, one finds that the separation between the points is only about 4° in longitude. In a 6-month period of time, the total number of observations is of the order of 5000.

DATA PRODUCTS

The basic data product is the extinction profile obtained during each measurement opportunity, which can be analyzed to determine the latitudinal, longitudinal, and temporal variations in the stratospheric aerosol. A detailed description of all the data products that are scheduled for routine archiving is given in section 5 of The Nimbus 7 User's Guide (ref. 12). These include tapes of the following: raw radiance as a function of time for each sunrise and sunset; and aerosol extinction coefficient, molecular extinction coefficient, and modeled aerosol number density as a function of altitude.

This report presents a portion of these data. Specifically, it contains the eighth 6-month's data of the following: weekly averages of SAM II extinction profiles; a 1-day sample for each week of aerosol extinction as a function of altitude and longitude; isopleths of weekly averaged extinction profiles plotted against time; and tables of weekly averaged stratospheric optical depth. These and the many data products generated represent far too much material to present in a reasonably sized report. It was decided, therefore, to present instead averages and representative samples of the data products. Where appropriate, the temperature profile or average temperature profile for the location at which the SAM II measurements were made is given with the aerosol data. The temperature data were supplied by the National Meteorological Center of the National Weather Service of NOAA and are interpolated from their gridded global data sets (ref. 13). The optical-depth data are calculated directly from the aerosol extinction profile (which gives aerosol extinction coefficient as a function of altitude) by integrating between the altitude levels of interest. These data are presented in the form of tables.

EXTINCTION PROFILES

The average of all extinction profiles measured by SAM II for a given week and the corresponding average temperature profiles are presented in figures 2 to 11. The temperatures at given pressure levels of 1000, 500, 300, 150, 100, 70, 50, and 10 millibars (1 millibar = 100 Pa) are provided by NOAA for each SAM II measurement. These are averaged to give a temperature at each pressure level and plotted at the average altitude of that level. The horizontal bars on both the extinction and temperature profiles show the one-standard-deviation range in the data. When available the tropopause height (averaged over each week) is indicated by a horizontal arrow near the left ordinate. The average latitude for the week is given on each plot. The profiles in figures 2 to 6 for the Arctic region and in figures 7 to 11 for the Antarctic region show very high values. This is primarily due to the April 27, 1981, eruption of Alaid (50.8° N, 155.5° E), the late 1981 to early 1982 eruption of an unknown volcano, and the March 28, April 3, and April 4, 1982, eruptions of El Chichon (17.3° N, 93.2° W). Figures 8 to 10 show the influence of polar stratospheric clouds (PSC's) on the profiles for the Southern Hemisphere during winter.

EXTINCTION ISOPLETHS

Figures 12 to 63 present isopleths of aerosol extinction and temperature contours for a 1-day sample taken from each week of the 6-month period. The extinction isopleths are plotted as extinction as a function of altitude and longitude and were generated from the 14 individual extinction profiles for the particular day by using a cubic-spline contouring program. The tension of the cubic-spline fit was set at 2.5. Once again, because of the large amount of data, all the isopleths obtained are not presented. Instead, 1 day from each week has been randomly chosen for presentation. The dates for the day are indicated in the legends as they are given in the computer. The decimal fraction refers to the time of day. (For example, April 28.09 means 2:10 a.m. on April 28.) The values labeled on the extinction isopleths are scaled by 10^5, and the value of the kth contour is equal to 1.32 times the value of the $k - 1$ contour. The isopleth marked "12" corresponds to an extinction of 1.20×10^{-4} km^{-1}. The plotting routine used truncates decimal points, so that the lines marked "1" correspond to 1.32×10^{-5} km^{-1}. The tick marks on the horizontal axes of each figure indicate the longitude of the individual profile measurement that was incorporated into the isopleth. The vertical line indicates the prime meridian (0° E). The tropopause height, when available, is indicated with a circle containing a plus sign ($\oplus$). The lines between the extinction values at the tick marks are interpolations between one extinction profile and the next. This should be kept in mind when interpreting the data. Note that in some of the plots all 14 data profiles for the day were not available.

The temperature contours are labeled in kelvins and are separated by 3 K. Local minimum values are marked with an "L" and maximum values with an "H."

Figures 12 to 37 show the Arctic measurements and figures 38 to 63 show the Antarctic measurements. The plots show rather interesting variations in the aerosol as a function of longitude. These variations have not been observed in measurements obtained with other methods because this satellite system is the first to obtain a high density of measurements in a short time interval, thus allowing such plots to be made. This set of plots also enables one to observe the correlations which exist between the aerosol extinction and the temperature. For example, some of the plots reveal the presence of PSC's, which occur in the Antarctic region in the winter. (See figs. 45 to 60.) The corresponding temperature fields show very low temperatures at the location of the PSC's. The stratospheric-cloud sightings are described in detail by McCormick et al. in reference 14. Finally, the presence of tropospheric clouds and aerosols extending up to the tropopause are easily seen.

SIX-MONTH AVERAGE OF AEROSOL EXTINCTION

Figures 64 and 65 present contours of the weekly average of aerosol extinction as a function of time. The corresponding weekly average of temperature is also shown.

In each figure the average weekly aerosol extinction at 1-km altitude intervals is plotted as a function of altitude and time. Each average weekly aerosol value can be regarded as a zonal mean since the latitude coverage is only about 1 degree per week and measurements made during a week span 360° longitude, with a spacing of about 4°. The temperature plots were generated by evaluating the weekly average temperature at 1-km intervals and plotting isotherms as a function of altitude and time. Figure 64 is for the Arctic region and figure 65 is for the Antarctic region. Further descriptions and analyses of these plots are found in McCormick et al. (ref. 15).

OPTICAL DEPTH

Tables I and II contain weekly averaged values of the aerosol optical depth for the Arctic and Antarctic measurements. The optical-depth value depends critically on the method used for its evaluation. The optical depths are obtained by evaluating the integral of each extinction profile from a given altitude to 30 km. These profiles were evaluated from 2 km above the tropopause up to 30 km. If the lowest point at which extinction values are available is higher in altitude than the tropopause plus 2 km, then the value of extinction at that point is extended down to the tropopause plus 2 km. The optical depths obtained from all the extinction profiles during a given week are then averaged and the resultant values are presented in the tables, week by week, for the period covered by this report. An optical-depth value of 100 is 100×10^{-5}, or 0.001. Also included in the tables are the average latitude of the measurement point and the average tropopause height for the particular week.

CONCLUDING REMARKS

This report has presented a representative sample and summaries of the eighth 6 months (Apr. 25, 1982, to Oct. 23, 1982) of the Stratospheric Aerosol Measurement (SAM) II satellite data. It is divided into Arctic and Antarctic measurements and includes consecutive weekly averages of aerosol extinction profiles, a representative 1-day isopleth (contours of aerosol extinction as a function of altitude and longitude) for each week, and contours of the weekly average of aerosol extinction as a function of altitude and time for this 6 months. In addition, the stratospheric aerosol optical depth, averaged for each week, is given in tabular form. Temperature data, provided by the National Weather Service from their gridded analysis corresponding to the time and location of the SAM II measurement, are included with the aerosol extinction data. They are plotted as average temperature profiles (or contours) or tropopause heights.

At the time of this report, about 8 years after its launch in October 1978, SAM II continues to provide high-quality data. This report is intended to provide representative and summary data in a ready-to-use visual format for rapid use in atmospheric and climatic studies. It is intended that future 6-month reports using this same format continue to be published.

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Hampton, VA 23665-5225
May 21, 1986

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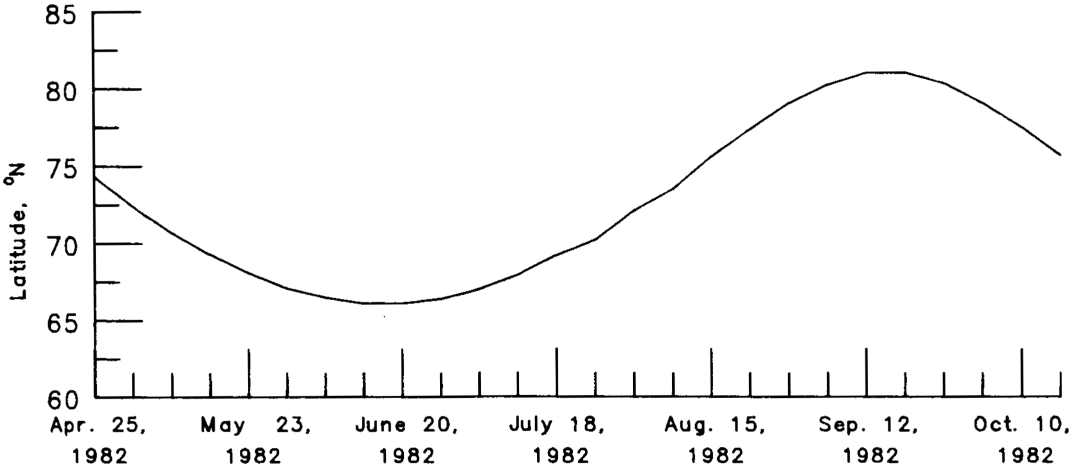
TABLE I.- AVERAGE OPTICAL DEPTH FOR ARCTIC REGION

Week beginning -	Latitude, °N	Average tropopause height, km	Average optical depth measured from tropopause plus 2 km
Apr. 25, 1982	74.3	7.76	720.1×10^{-5}
May 2, 1982	72.4	8.18	774.6
May 9, 1982	70.7	8.44	853.3
May 16, 1982	69.3	8.85	1123.8
May 23, 1982	68.1	8.93	1471.6
May 30, 1982	67.1	9.22	1393.0
June 6, 1982	66.5	9.55	1327.0
June 13, 1982	66.1	9.78	1595.6
June 20, 1982	66.1	10.19	1579.3
June 27, 1982	66.4	10.24	1522.6
July 4, 1982	67.0	10.26	1617.1
July 11, 1982	67.9	10.24	1468.7
July 18, 1982	69.2	10.43	1512.5
July 25, 1982	70.2	10.21	1642.8
Aug. 1, 1982	72.1	10.05	1626.6
Aug. 8, 1982	73.5	9.84	1661.6
Aug. 15, 1982	75.6	9.63	1980.6
Aug. 22, 1982	77.4	9.48	1844.6
Aug. 29, 1982	79.1	9.03	1898.4
Sept. 5, 1982	80.3	9.01	1871.8
Sept. 12, 1982	81.1	8.67	1824.9
Sept. 19, 1982	81.1	8.92	1989.2
Sept. 26, 1982	80.4	9.40	2018.1
Oct. 3, 1982	79.1	9.21	2351.0
Oct. 10, 1982	77.5	8.67	2378.1
Oct. 17, 1982	75.7	8.85	2373.3

TABLE II.- AVERAGE OPTICAL DEPTH FOR ANTARCTIC REGION

Week beginning -	Latitude, °S	Average tropopause height, km	Average optical depth measured from tropopause plus 2 km
Apr. 25, 1982	72.7	8.14	319.9×10^{-5}
May 2, 1982	71.0	8.91	278.4
May 9, 1982	69.4	9.36	269.6
May 16, 1982	68.0	9.71	282.1
May 23, 1982	66.8	9.76	258.0
May 30, 1982	65.9	10.03	238.8
June 6, 1982	65.2	10.47	227.3
June 13, 1982	64.8	10.53	373.5
June 20, 1982	64.8	10.59	378.2
June 27, 1982	65.0	10.60	450.6
July 4, 1982	65.5	10.54	462.1
July 11, 1982	66.1	10.63	593.0
July 18, 1982	67.3	10.90	462.3
July 25, 1982	68.2	11.18	397.4
Aug. 1, 1982	69.9	11.55	607.6
Aug. 8, 1982	71.2	11.56	810.0
Aug. 15, 1982	73.2	11.34	697.6
Aug. 22, 1982	75.0	11.87	866.1
Aug. 29, 1982	76.7	10.95	740.6
Sept. 5, 1982	78.3	11.52	501.9
Sept. 12, 1982	79.6	10.62	664.1
Sept. 19, 1982	80.4	10.56	675.0
Sept. 26, 1982	80.5	11.57	171.3
Oct. 3, 1982	80.0	9.95	280.5
Oct. 10, 1982	78.8	10.30	215.8
Oct. 17, 1982	77.2	10.24	193.6



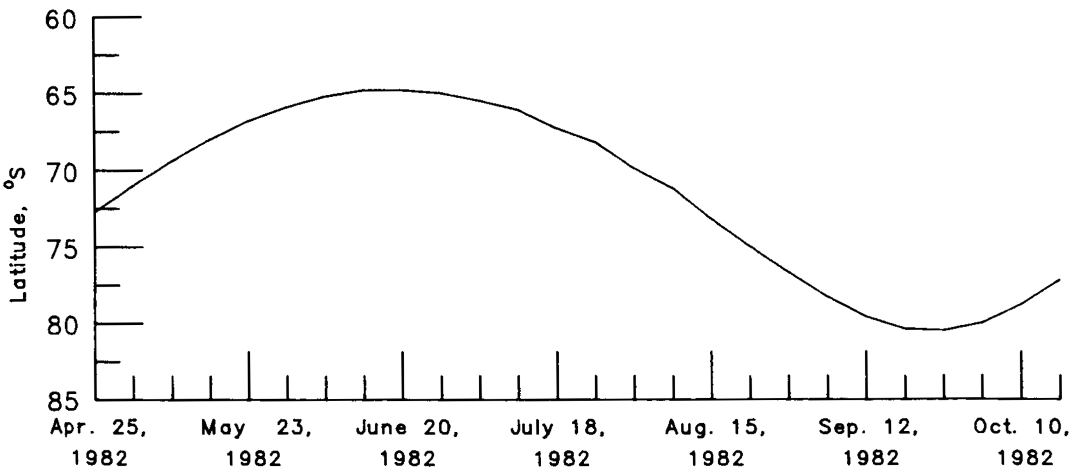


Figure 1.- Latitudinal coverage of SAM II measurements for April 1982 to October 1982.

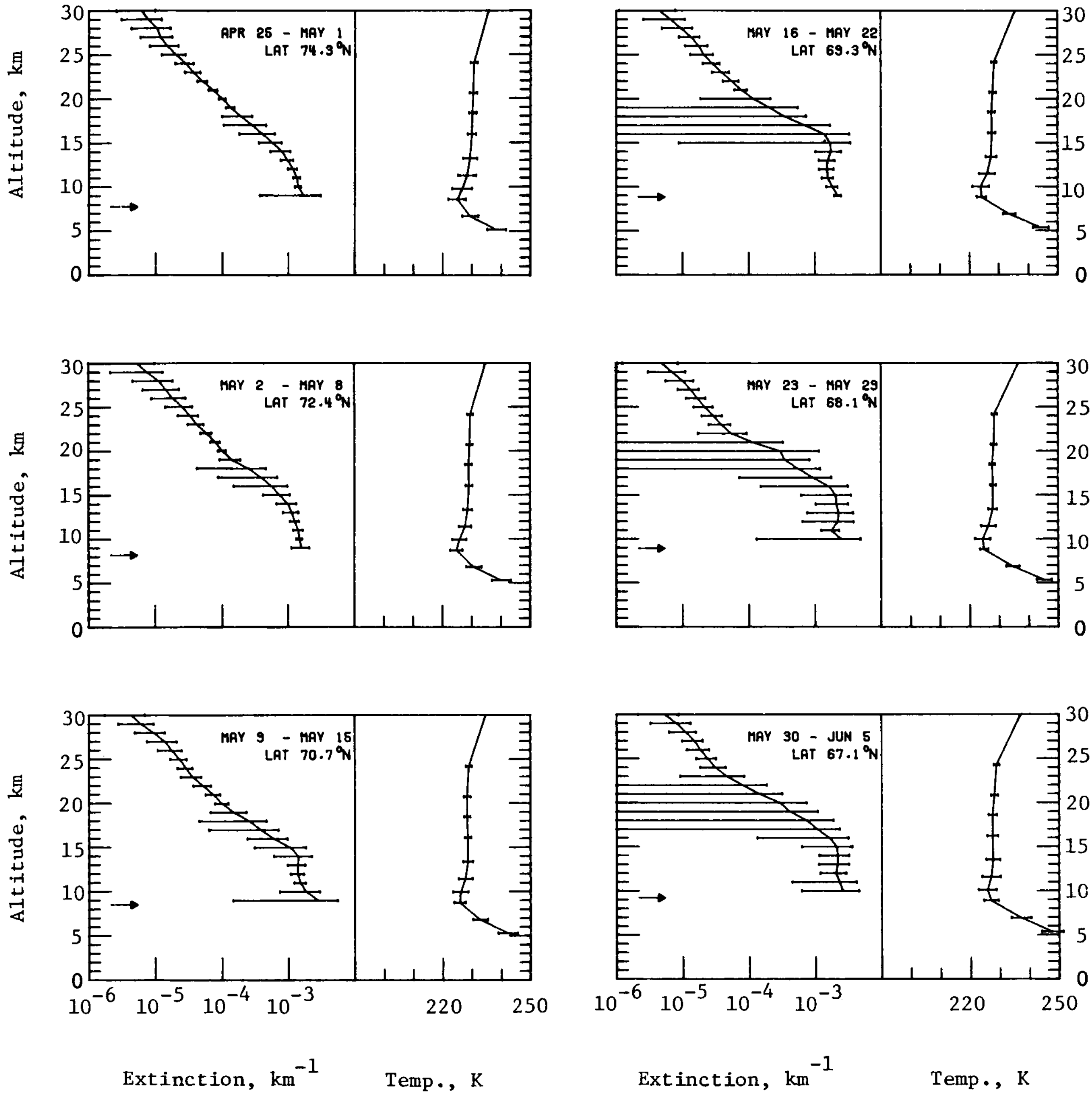


Figure 2.- Arctic extinction and temperature profiles for April 25 to June 5, 1982.

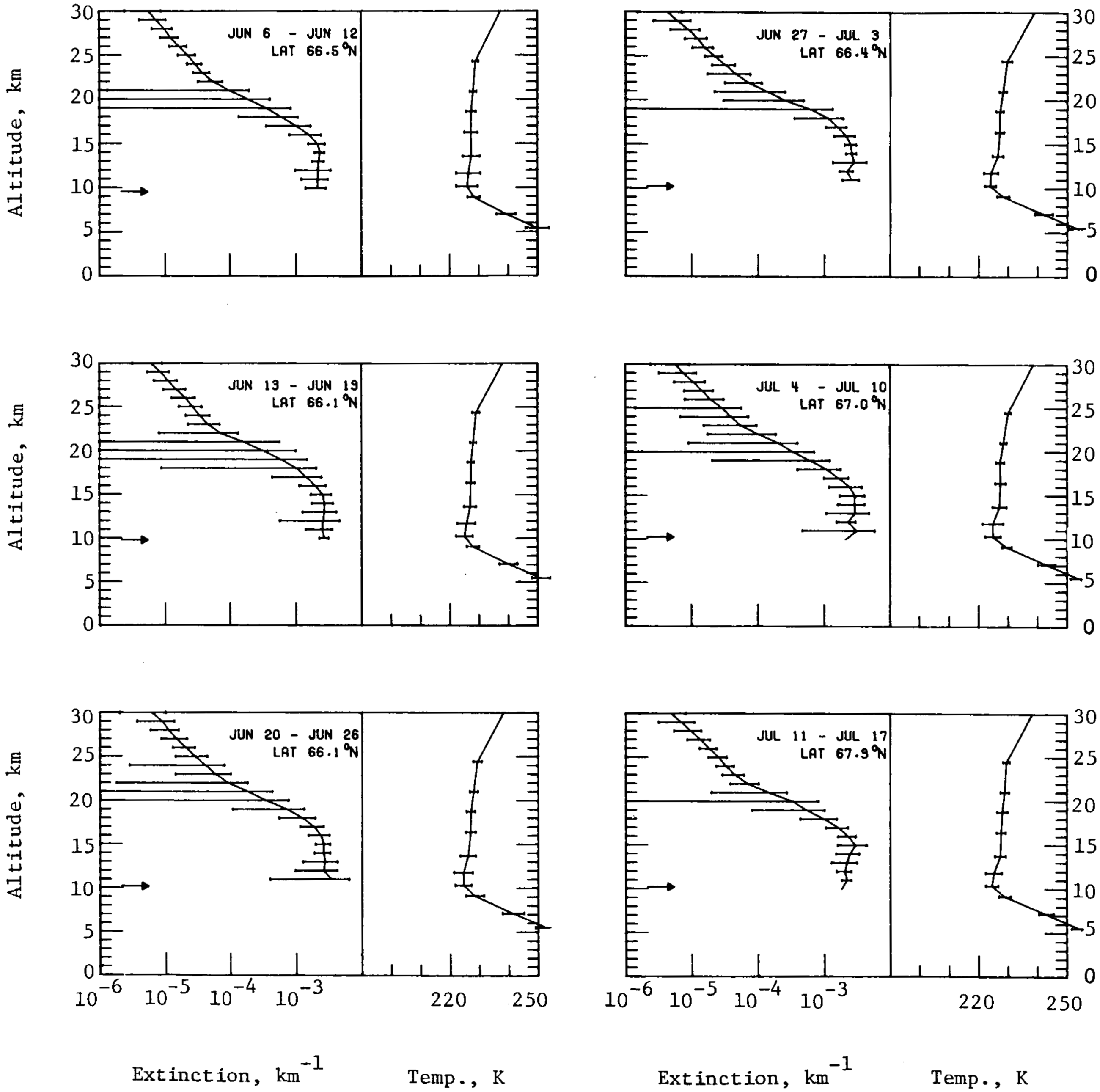


Figure 3.- Arctic extinction and temperature profiles for June 6 to July 17, 1982.

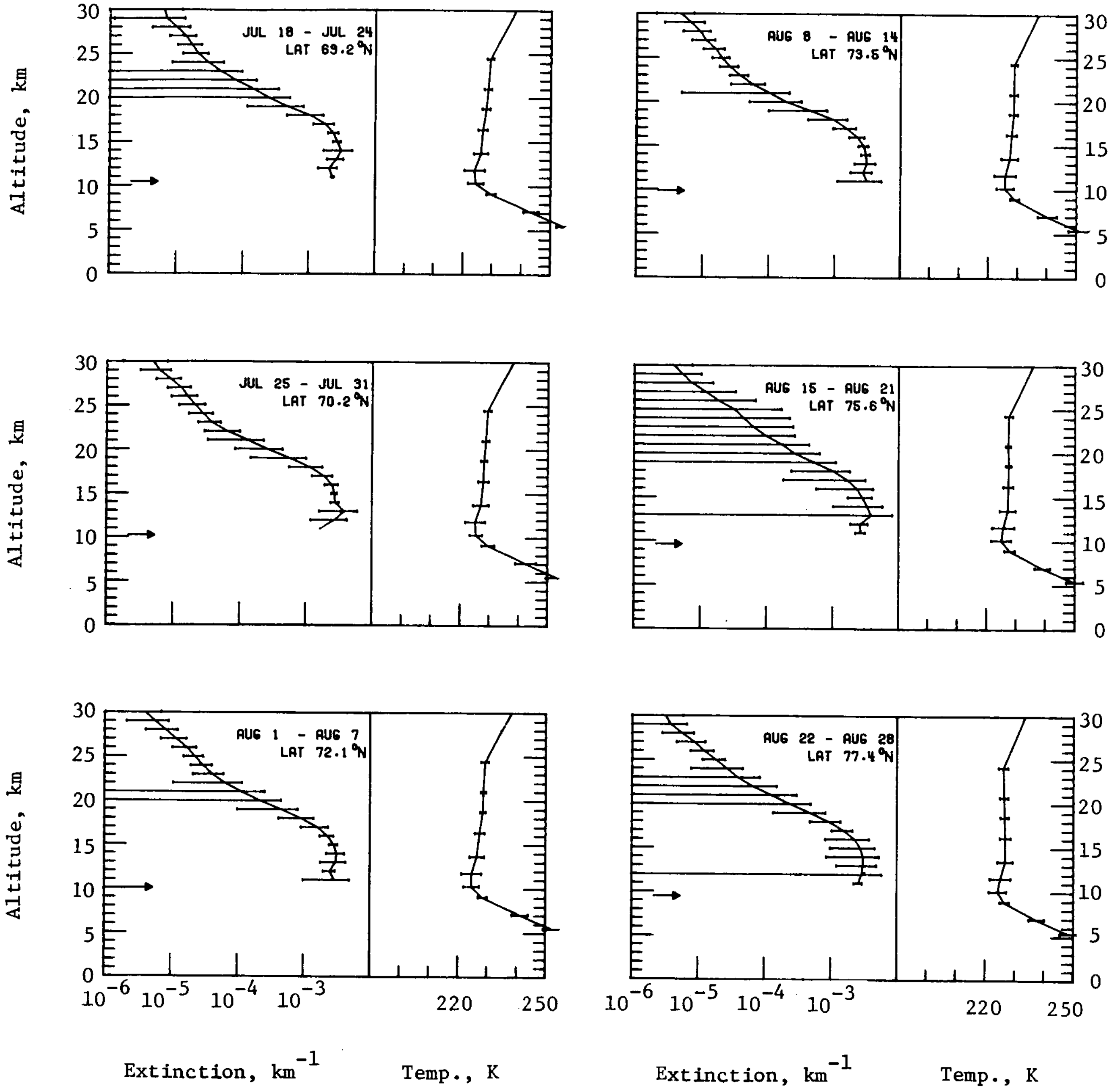


Figure 4.- Arctic extinction and temperature profiles for July 18 to August 28, 1982.

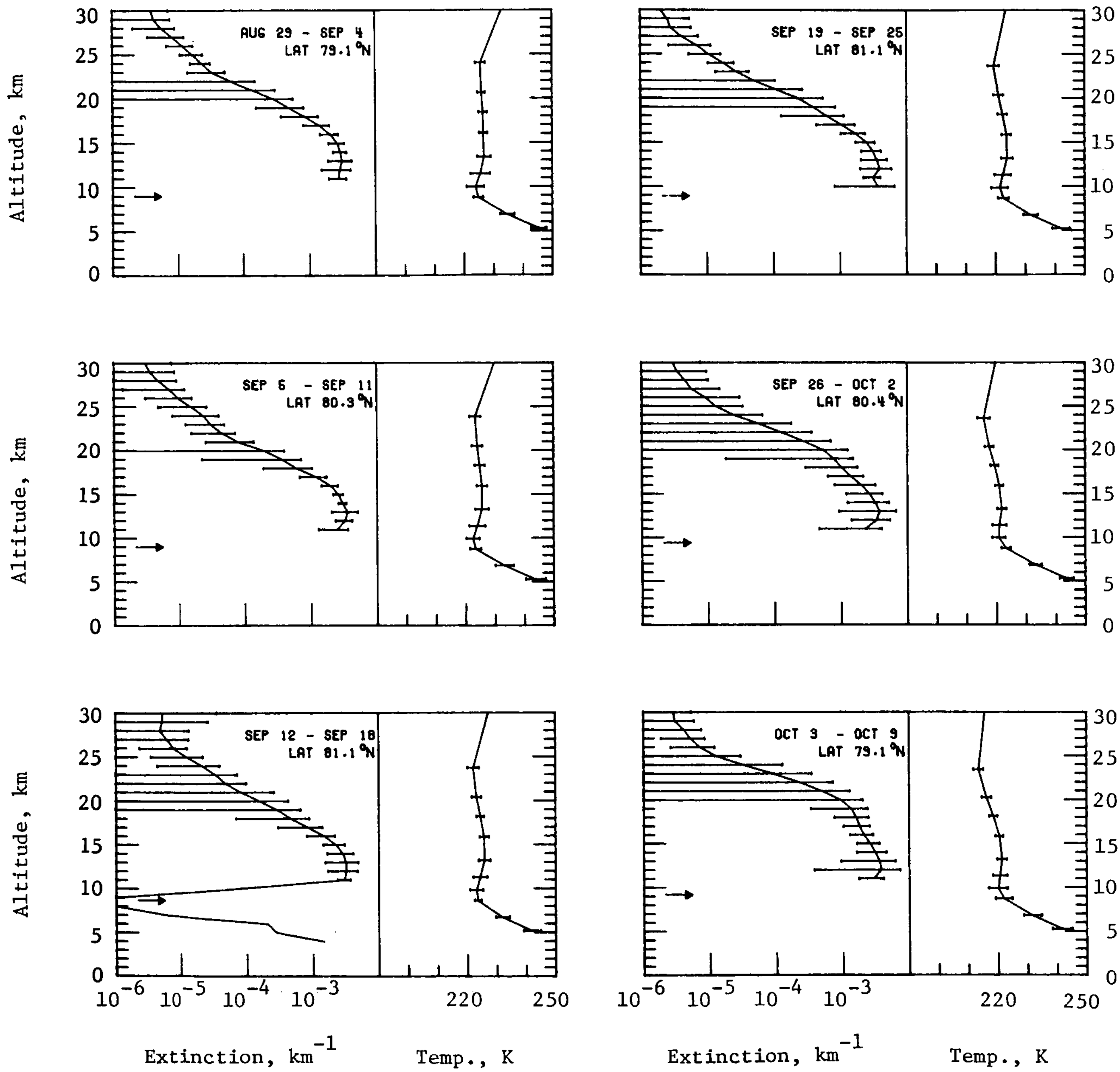


Figure 5.- Arctic extinction and temperature profiles for August 29 to October 9, 1982.

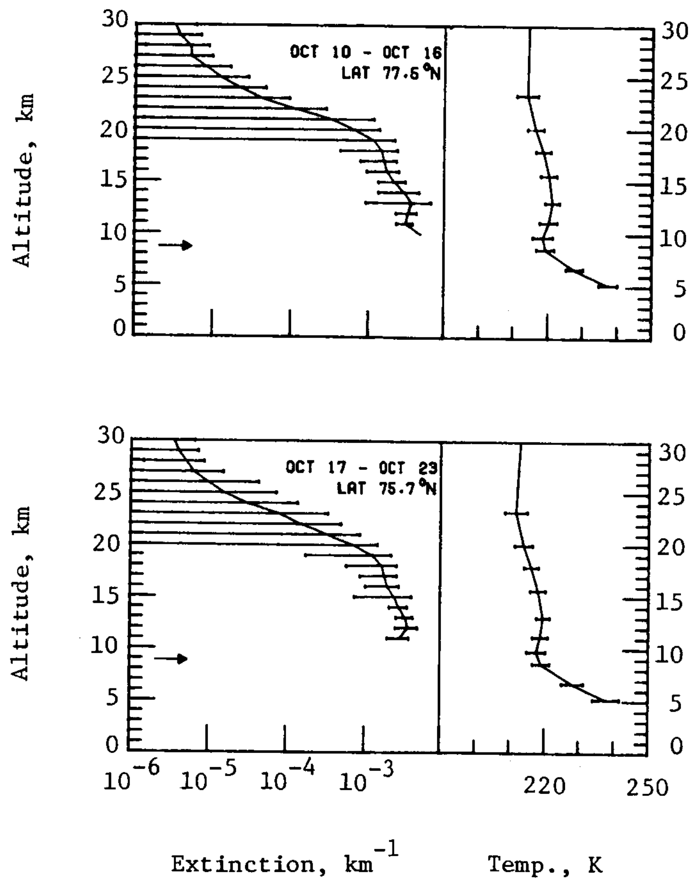


Figure 6.- Arctic extinction and temperature profiles for October 10 to October 23, 1982.

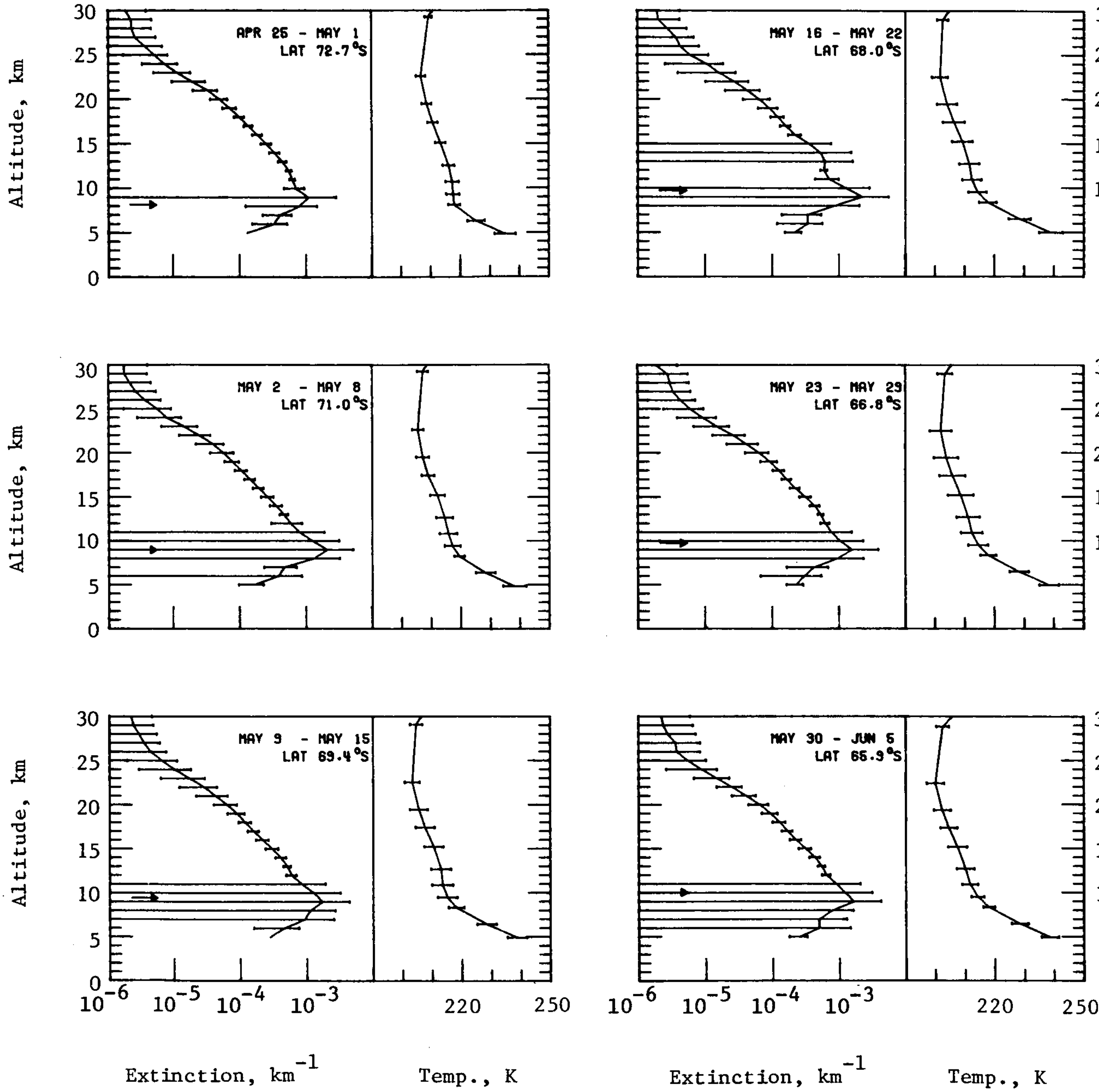


Figure 7.- Antarctic extinction and temperature profiles for April 25 to June 5, 1982.

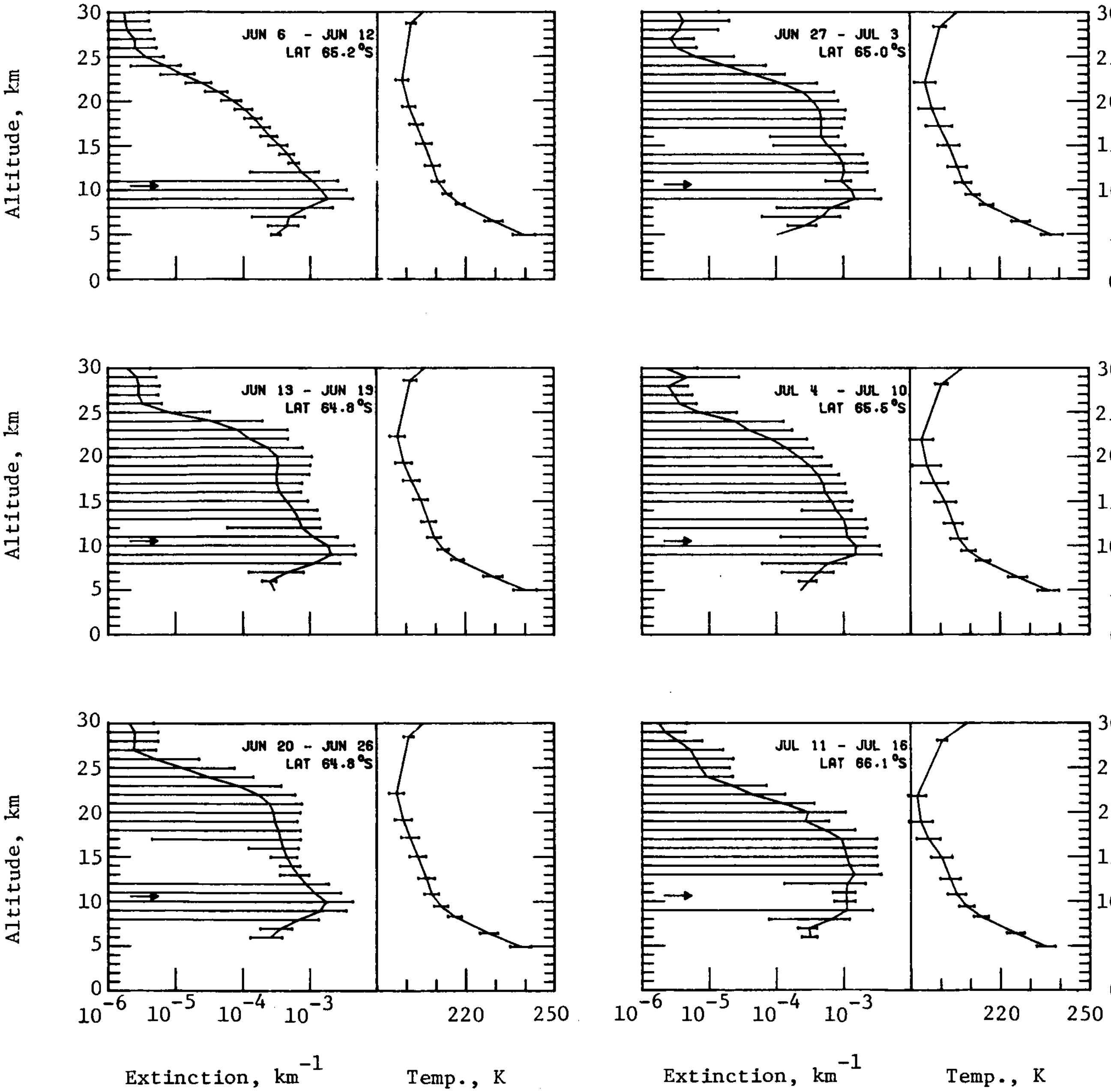


Figure 8.- Antarctic extinction and temperature profiles for June 6 to July 16, 1982.

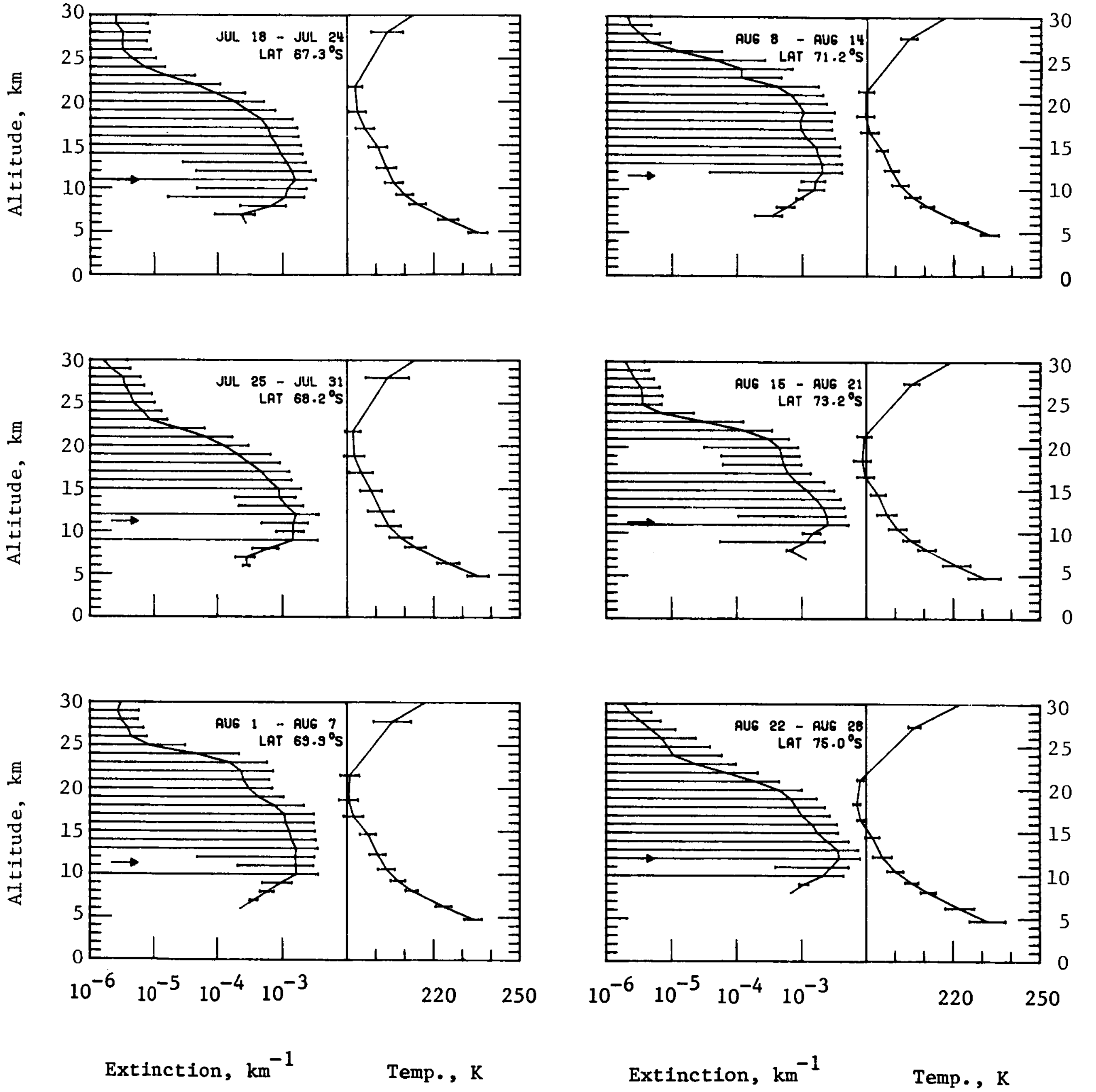


Figure 9.- Antarctic extinction and temperature profiles for July 18 to August 28, 1982.

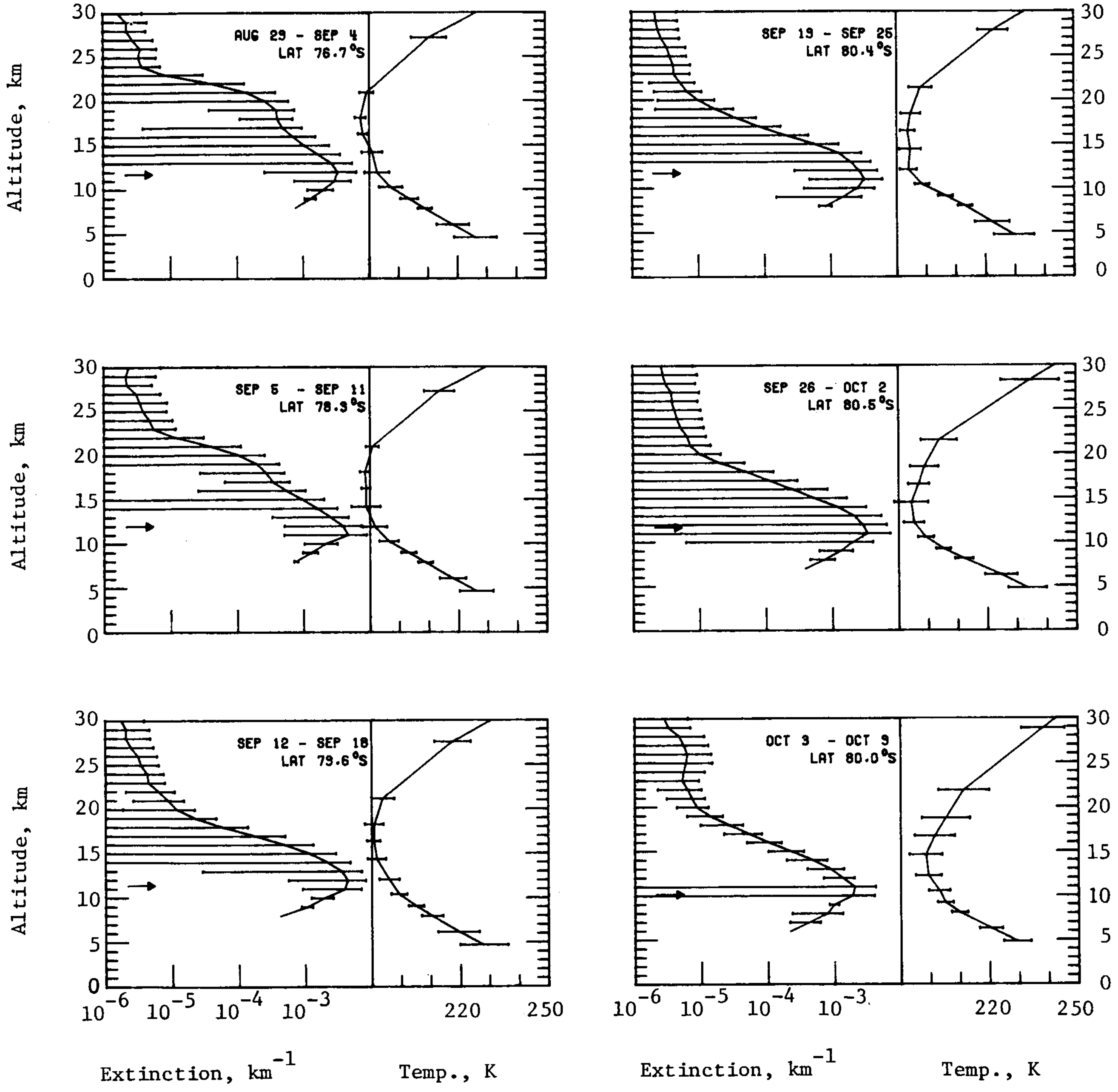


Figure 10.- Antarctic extinction and temperature profiles for August 29 to October 9, 1982.

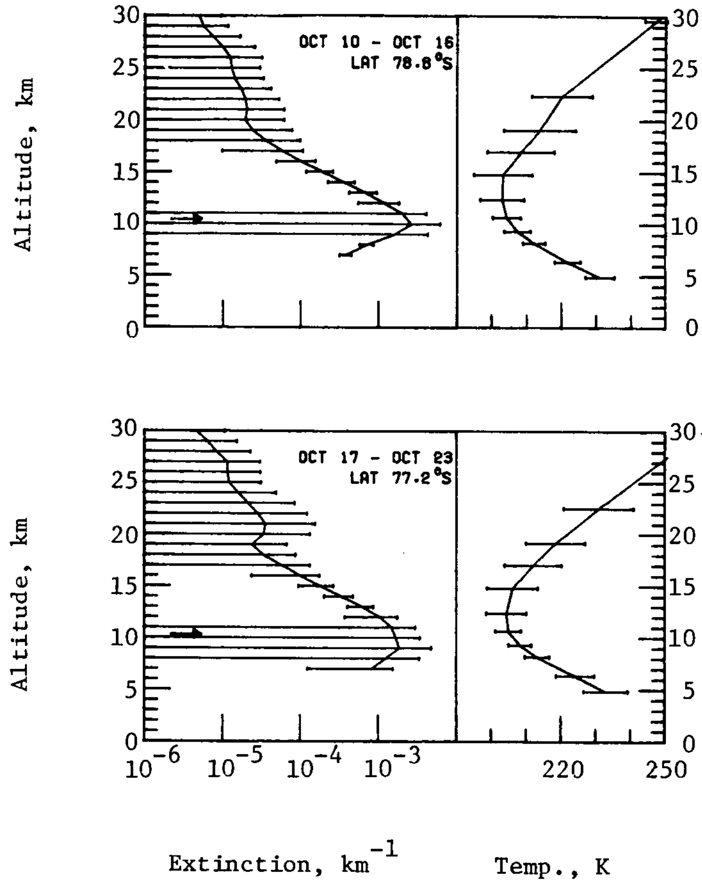
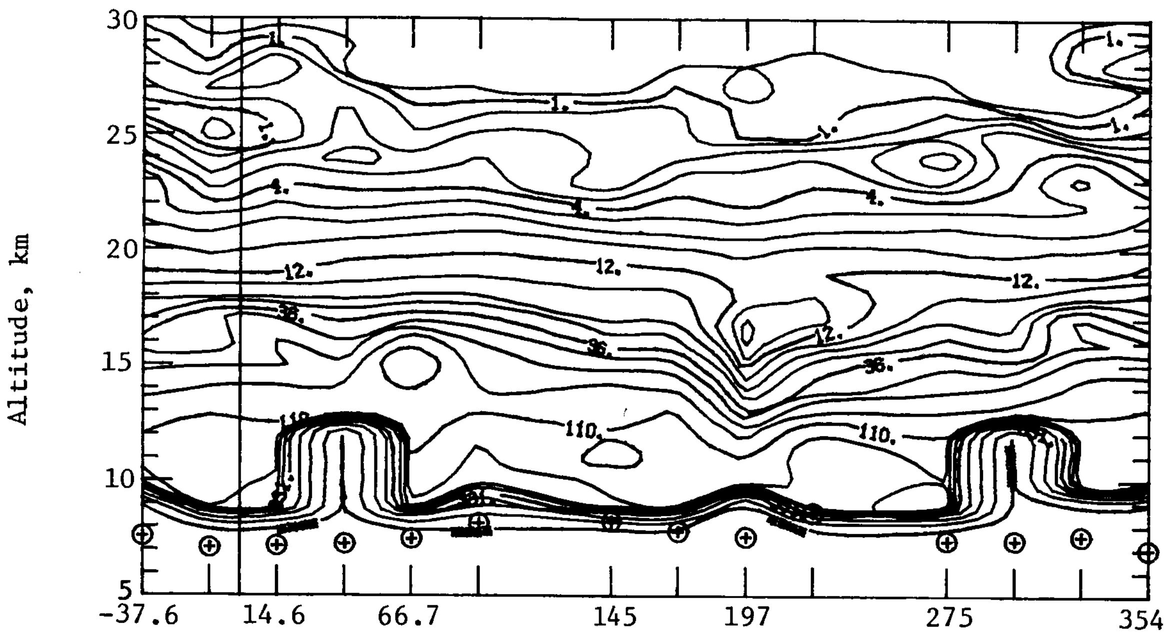
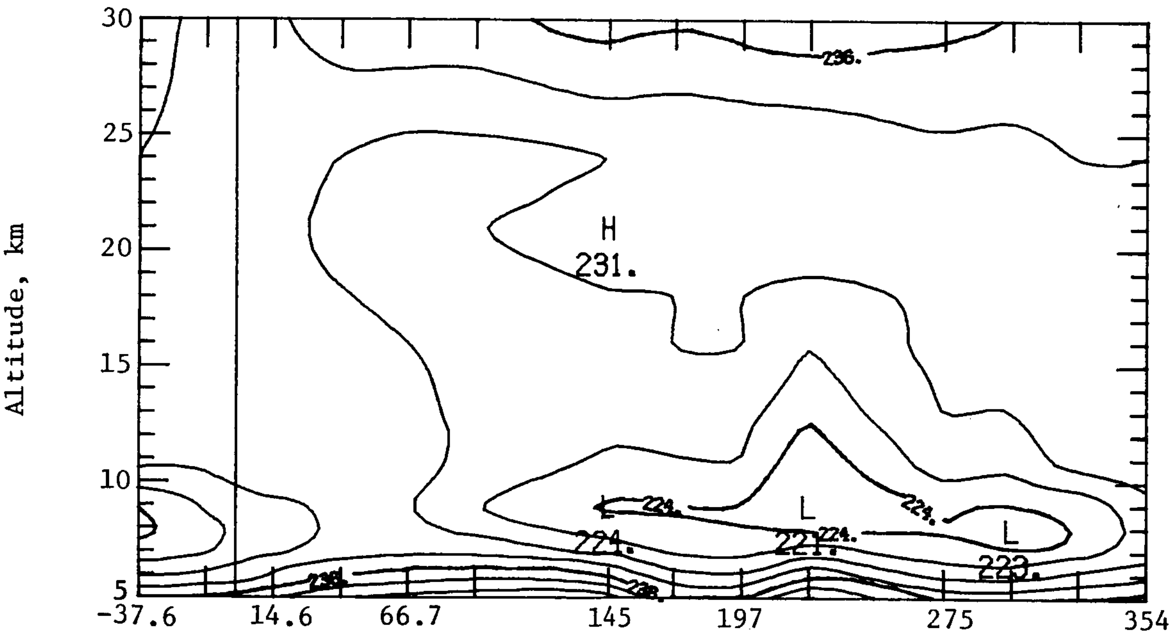


Figure 11.- Antarctic extinction and temperature profiles for October 10 to October 23, 1982.



Longitude, °E

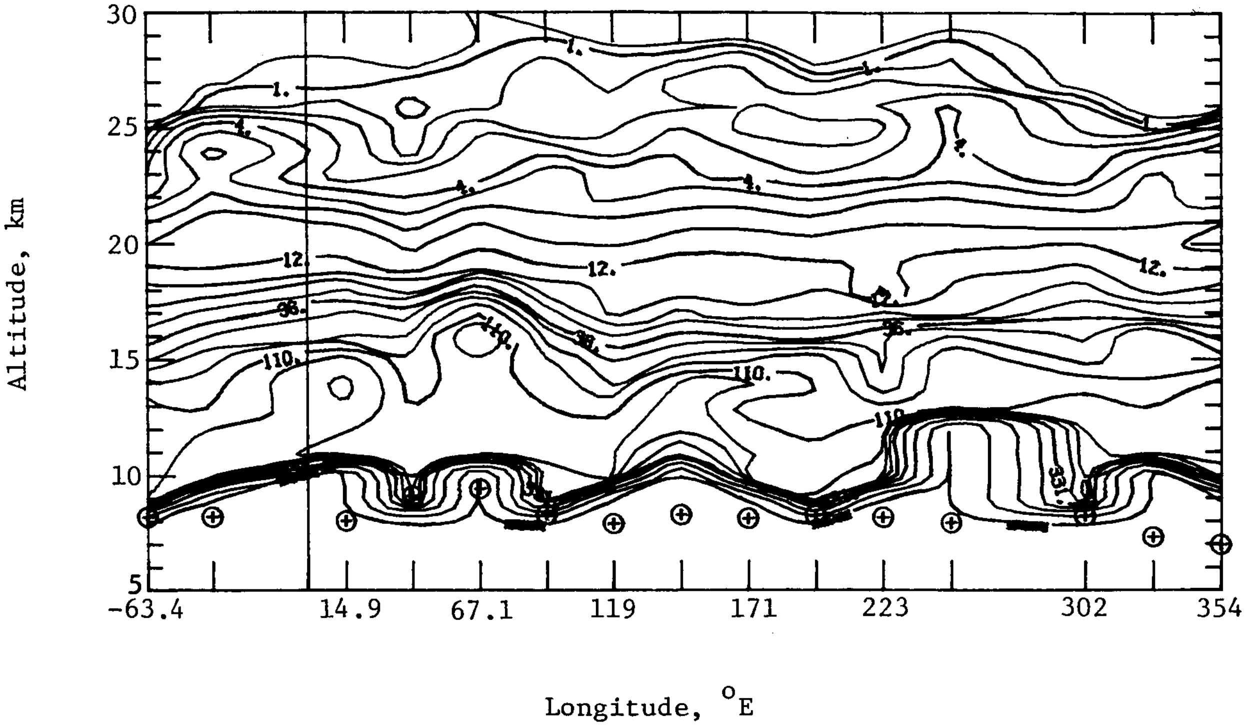
(a) Extinction isopleth.



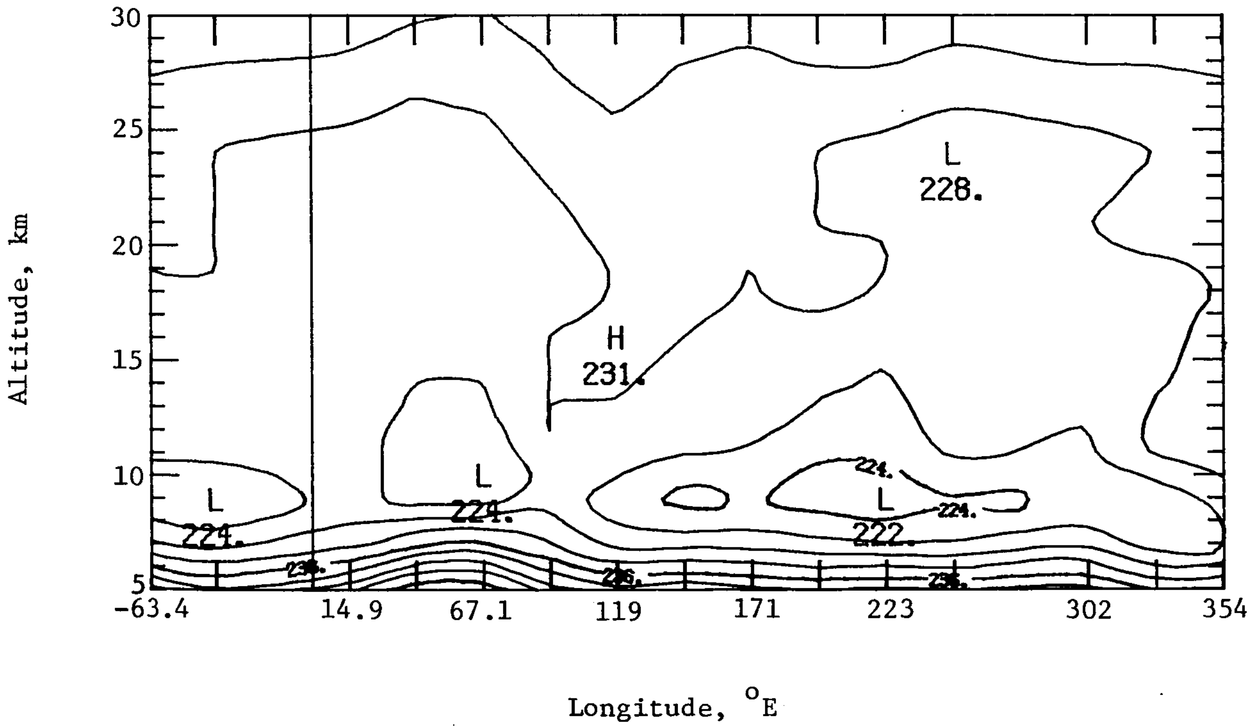
Longitude, °E

(b) Temperature contours.

Figure 12.- Arctic extinction isopleth and temperature contours for April 28.09 to 29.17, 1982, at latitudes from 74.4° to 74.1° N corresponding to orbits 17 715 to 17 730.

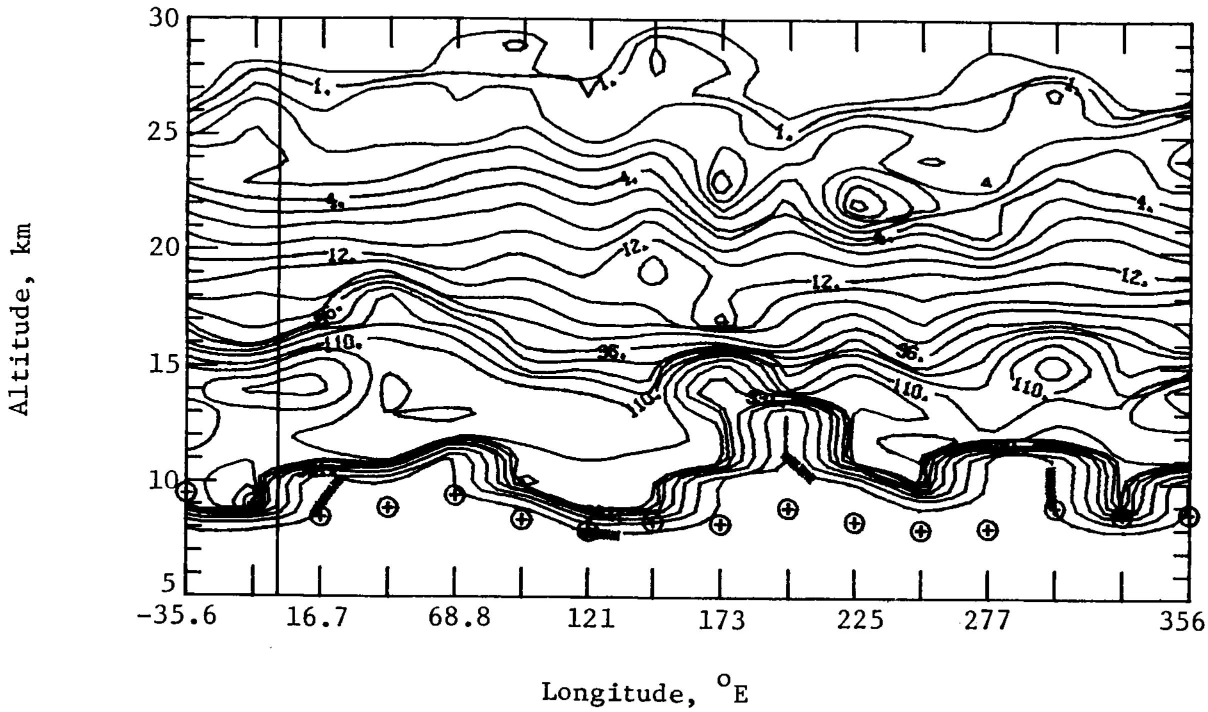


(a) Extinction isopleth.

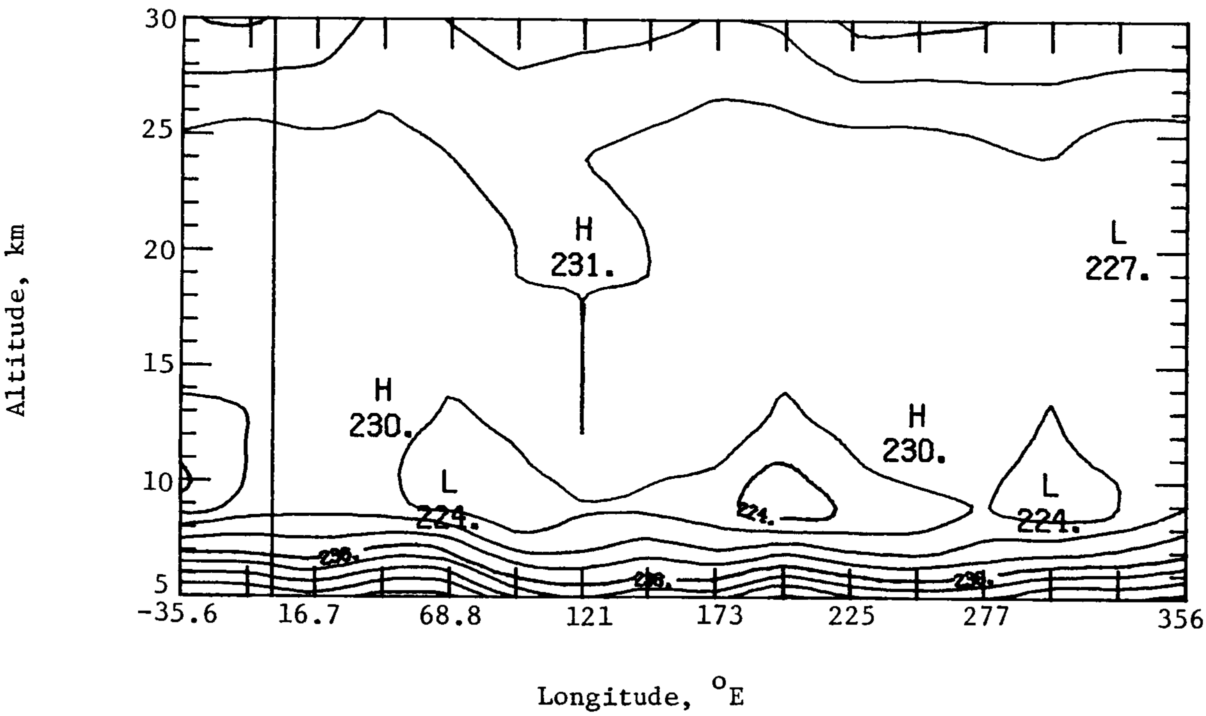


(b) Temperature contours.

Figure 13.- Arctic extinction isopleth and temperature contours for May 3.08 to 4.24, 1982, at latitudes from 73.1° to 72.8° N corresponding to orbits 17 784 to 17 800.

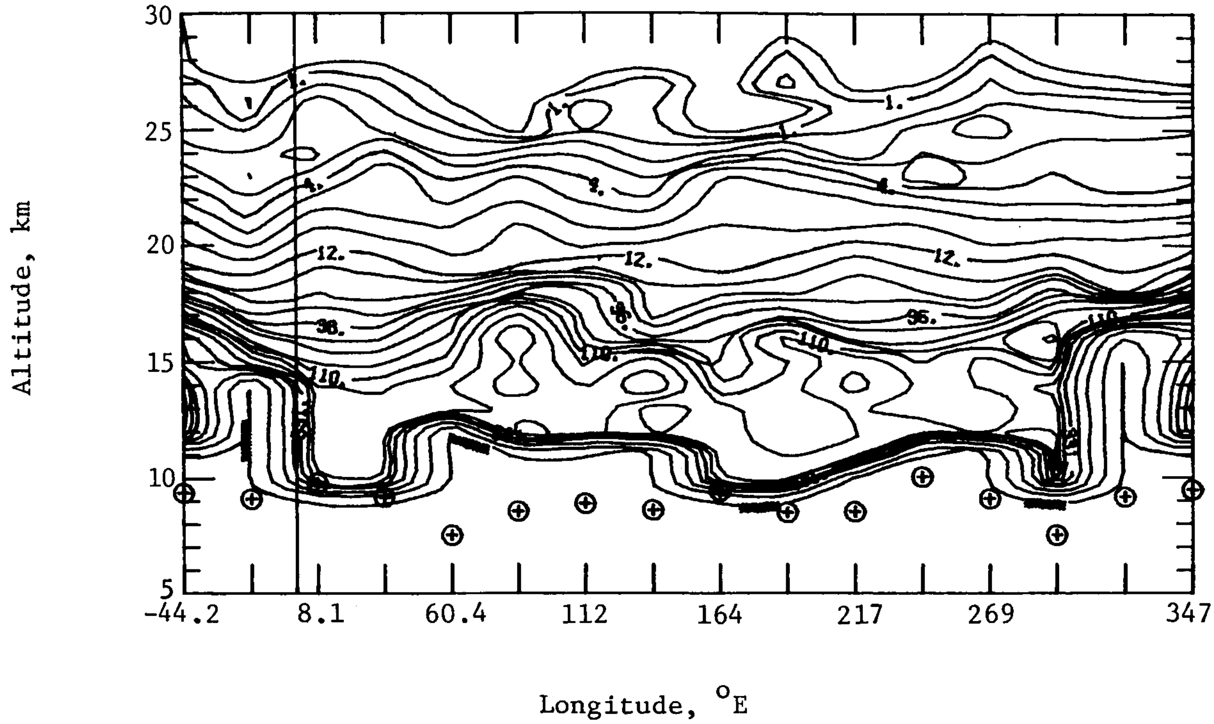


(a) Extinction isopleth.

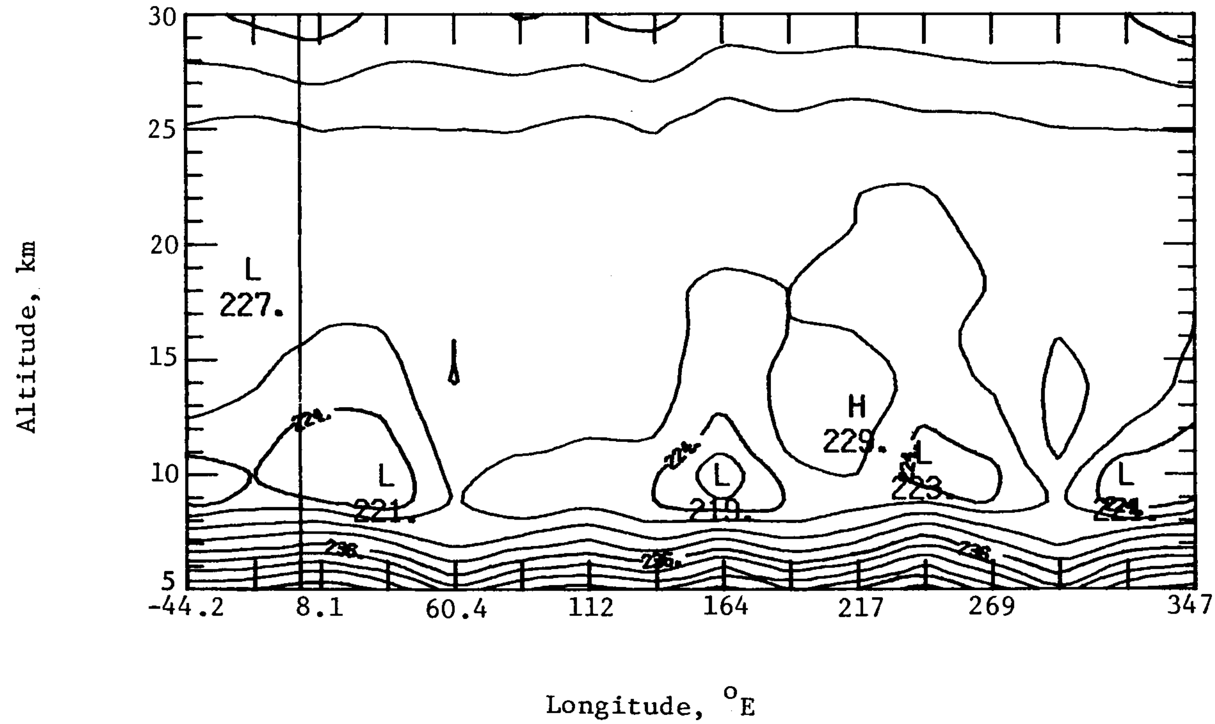


(b) Temperature contours.

Figure 14.- Arctic extinction isopleth and temperature contours for May 13.06 to 14.15, 1982, at latitudes from 70.6° to 70.4° N corresponding to orbits 17 922 to 17 937.

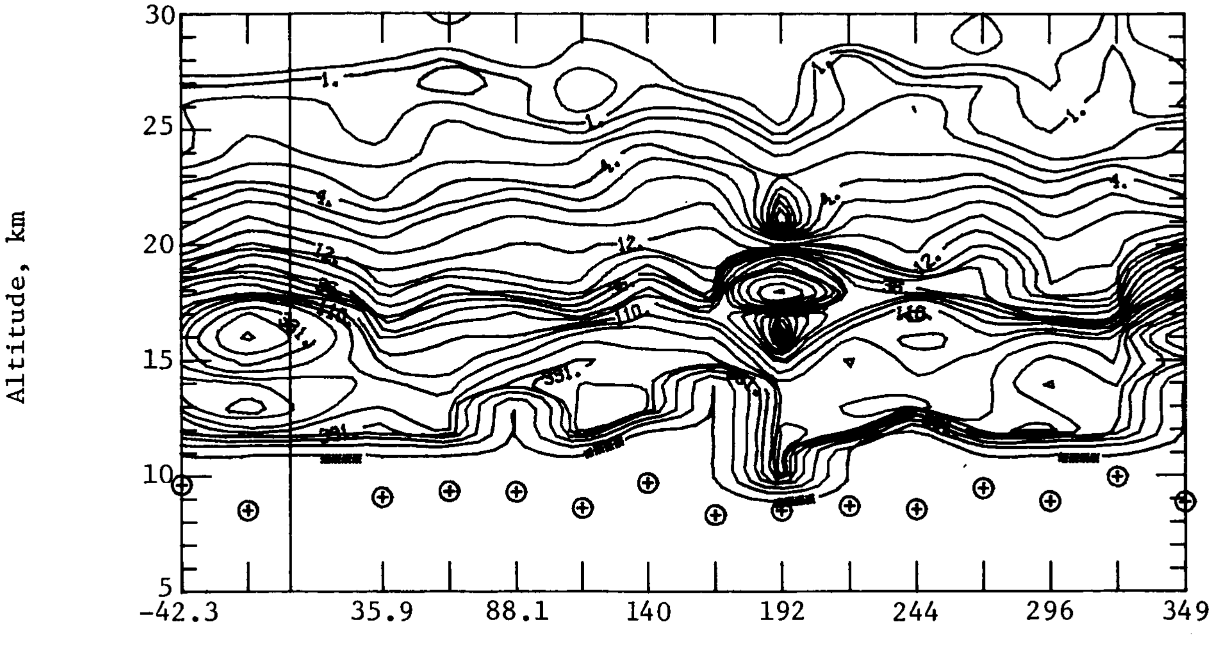


(a) Extinction isopleth.

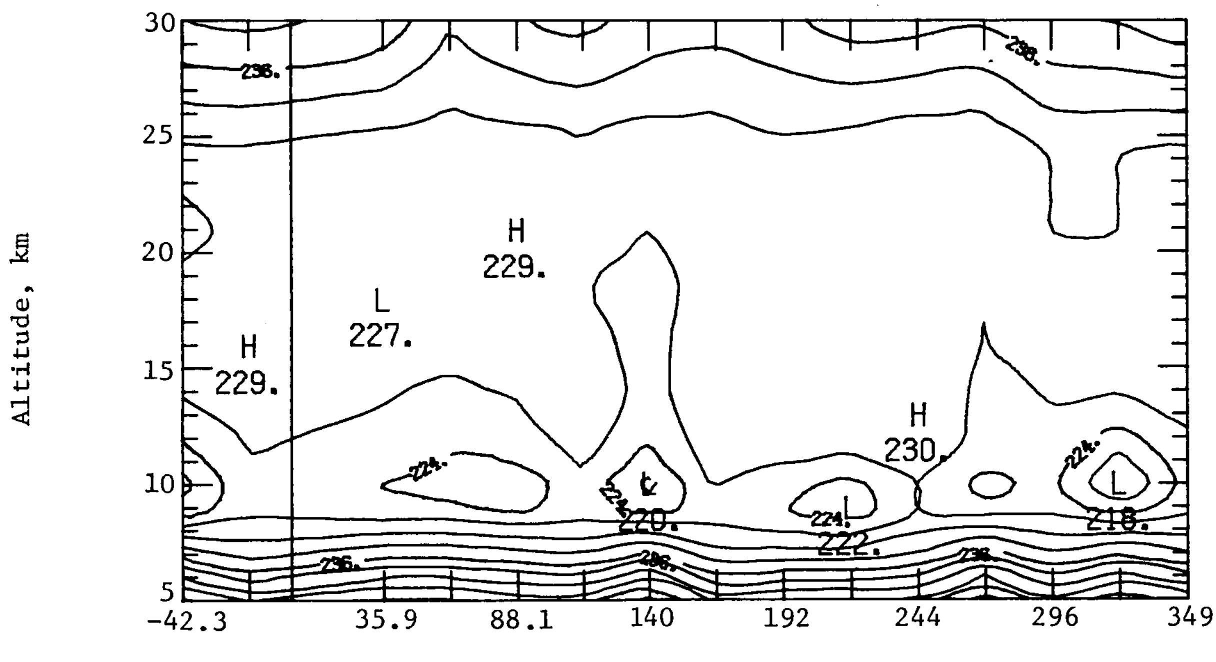


(b) Temperature contours.

Figure 15.- Arctic extinction isopleth and temperature contours for May 20.08 to 21.17, 1982, at latitudes from 69.2° to 69.0° N corresponding to orbits 18 019 to 18 034.

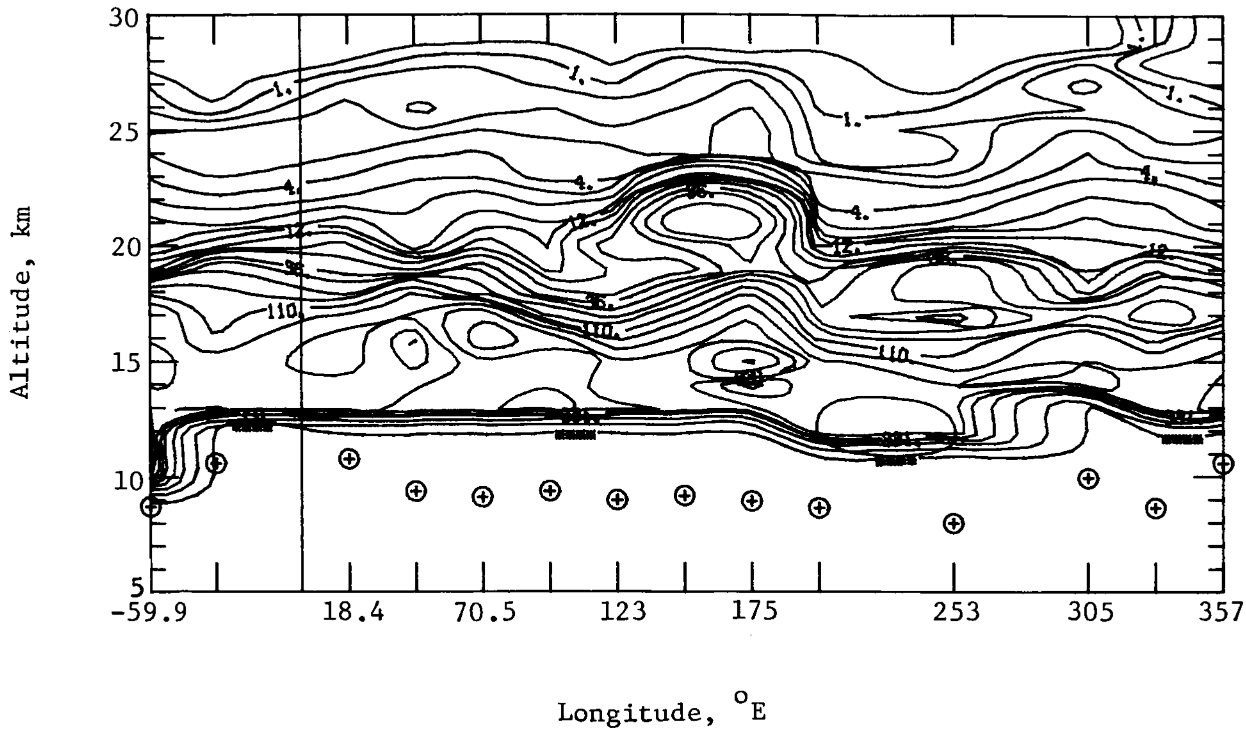


(a) Extinction isopleth.

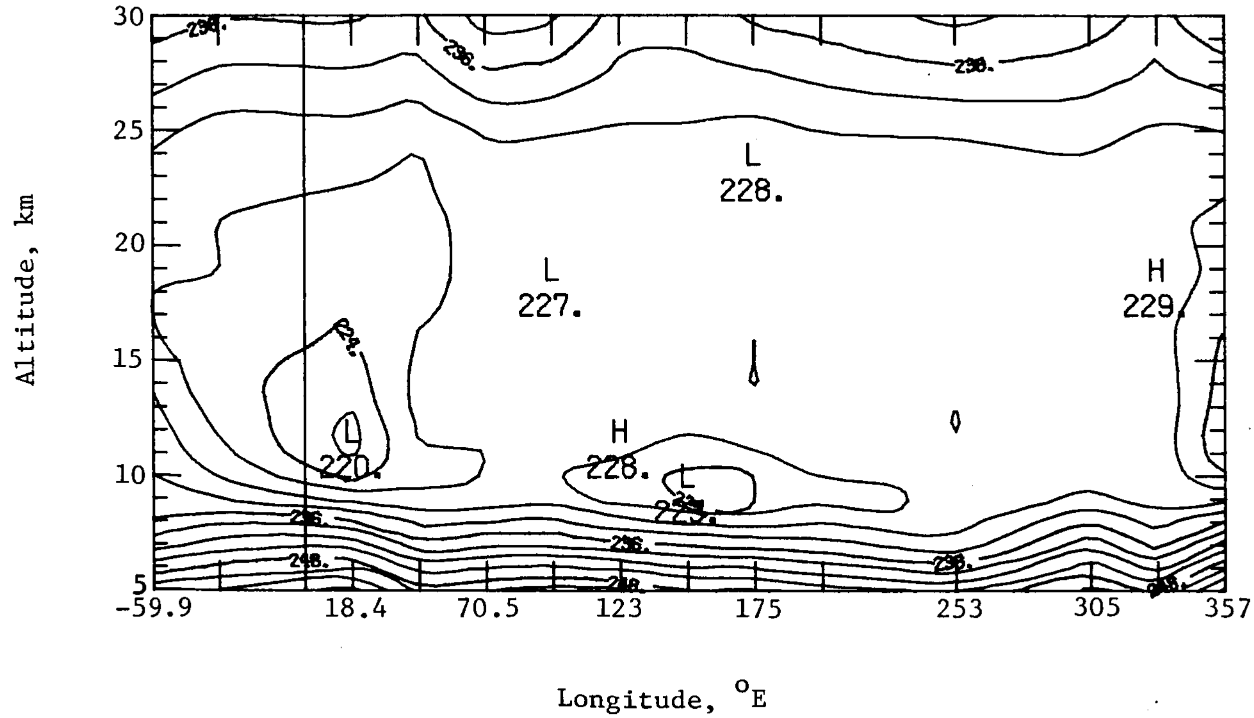


(b) Temperature contours.

Figure 16.- Arctic extinction isopleth and temperature contours for May 25.07 to 26.16, 1982, at latitudes from 68.3° to 68.1° N corresponding to orbits 18 088 to 18 103.

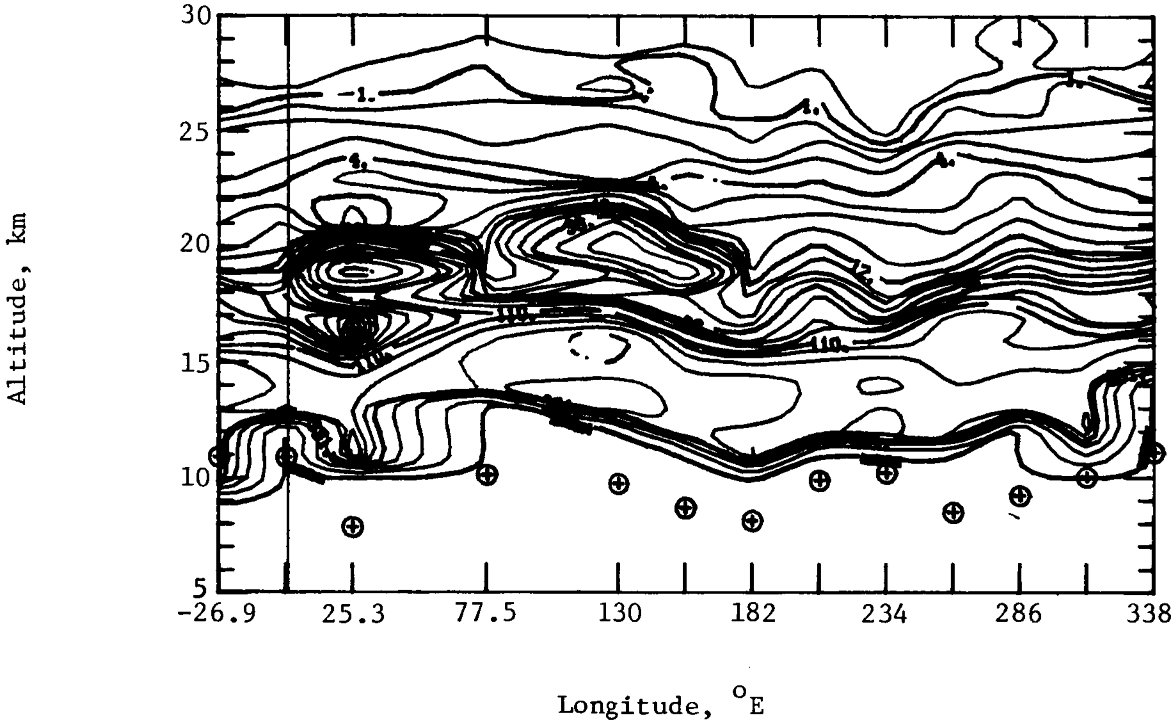


(a) Extinction isopleth.

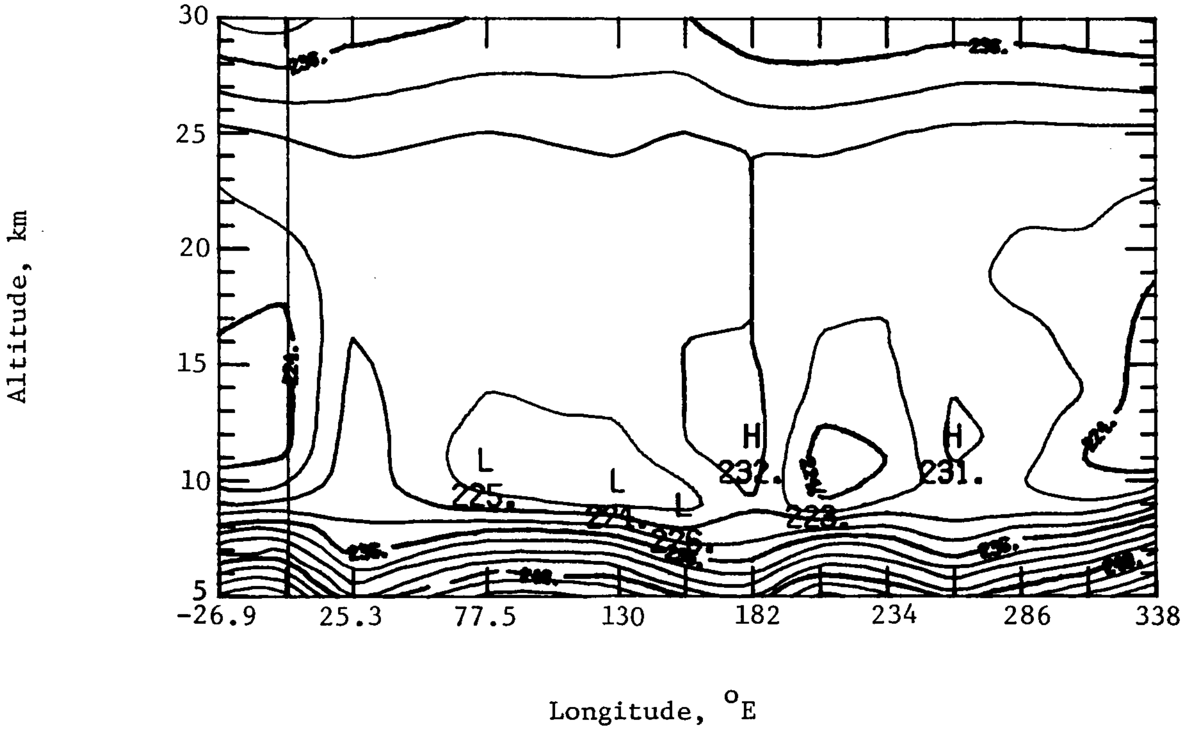


(b) Temperature contours.

Figure 17.- Arctic extinction isopleth and temperature contours for June 3.04 to 4.20, 1982, at latitudes from 67.1° to 66.9° N corresponding to orbits 18 212 to 18 228.

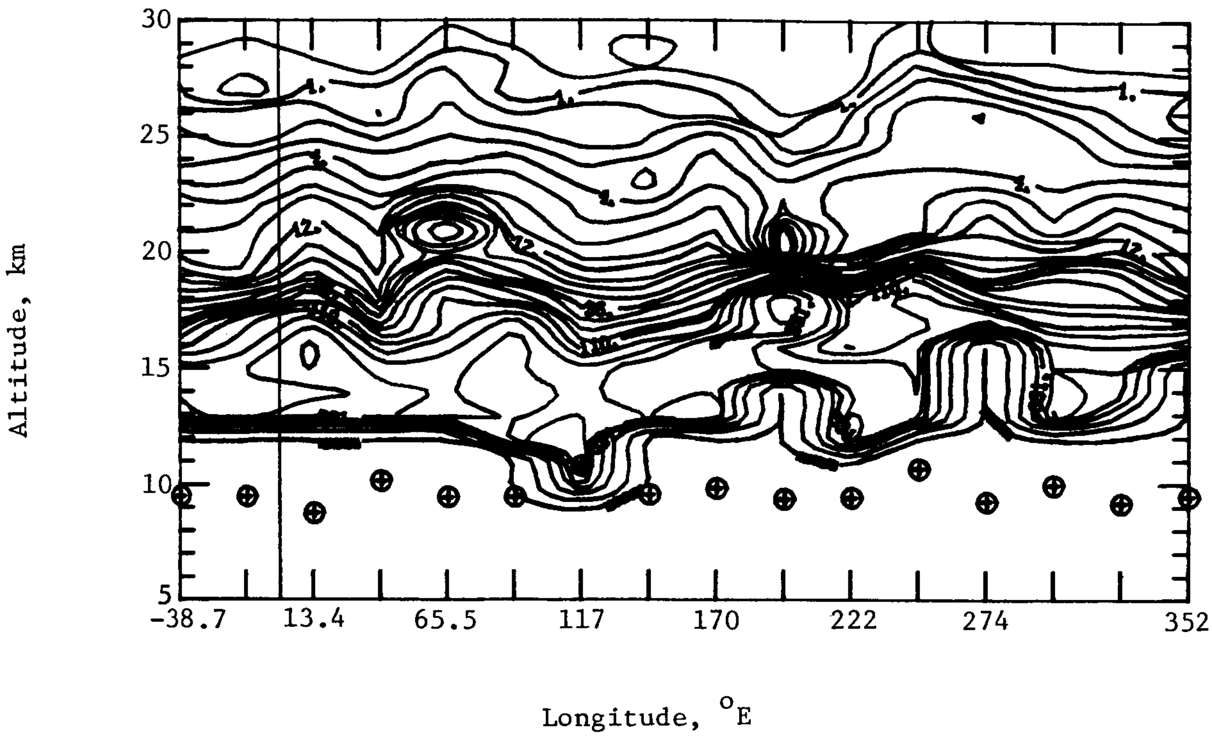


(a) Extinction isopleth.

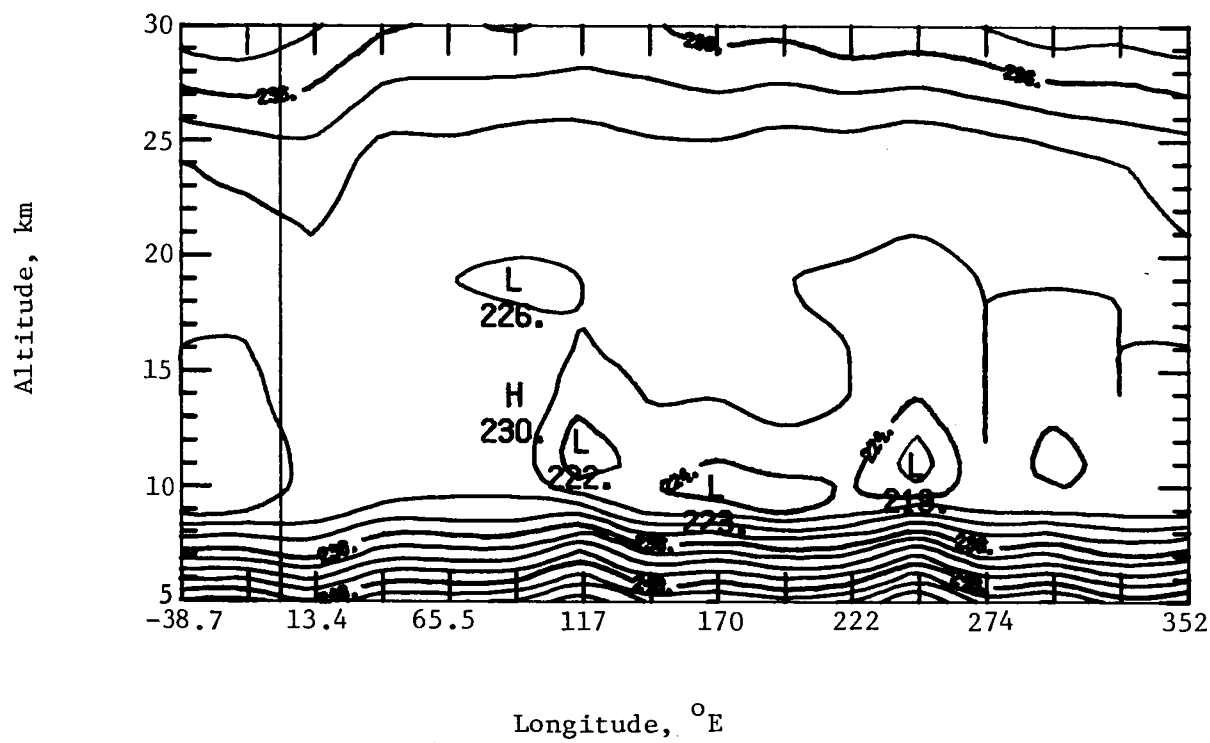


(b) Temperature contours.

Figure 18.- Arctic extinction isopleth and temperature contours for June 7.10 to 8.11, 1982, at latitudes from 66.7° to 66.6° N corresponding to orbits 18 268 to 18 282.

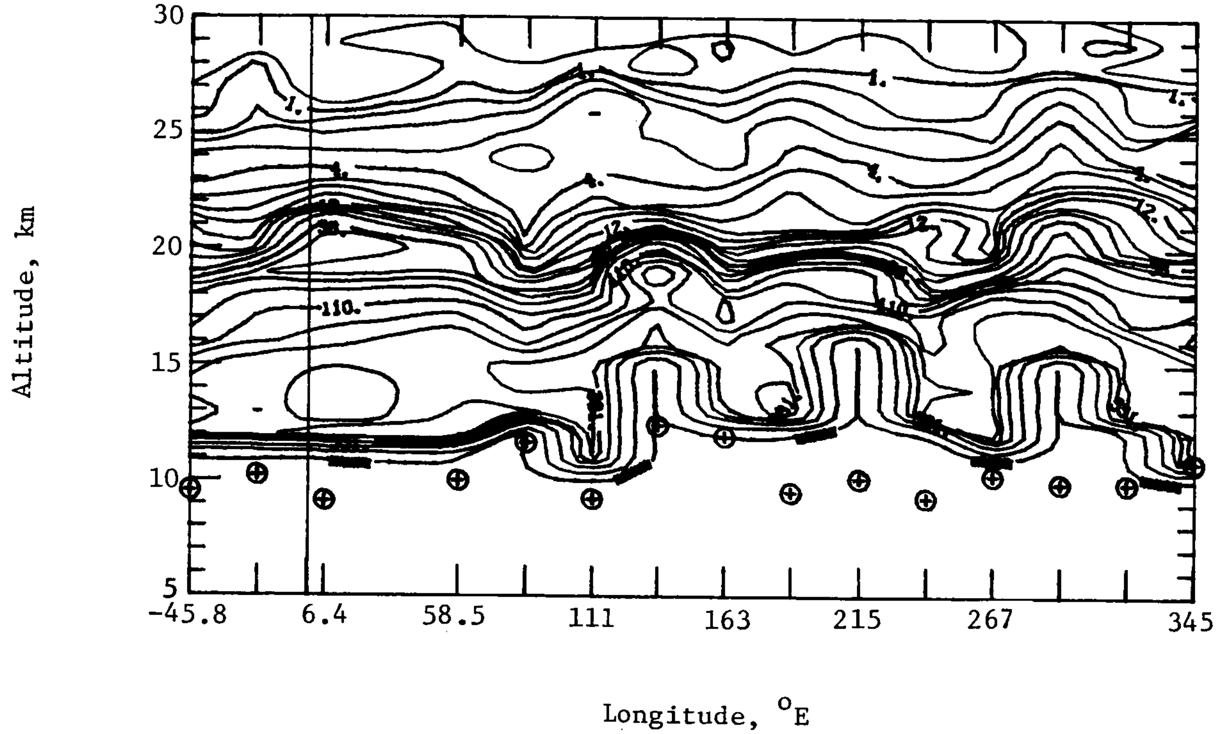


(a) Extinction isopleth.

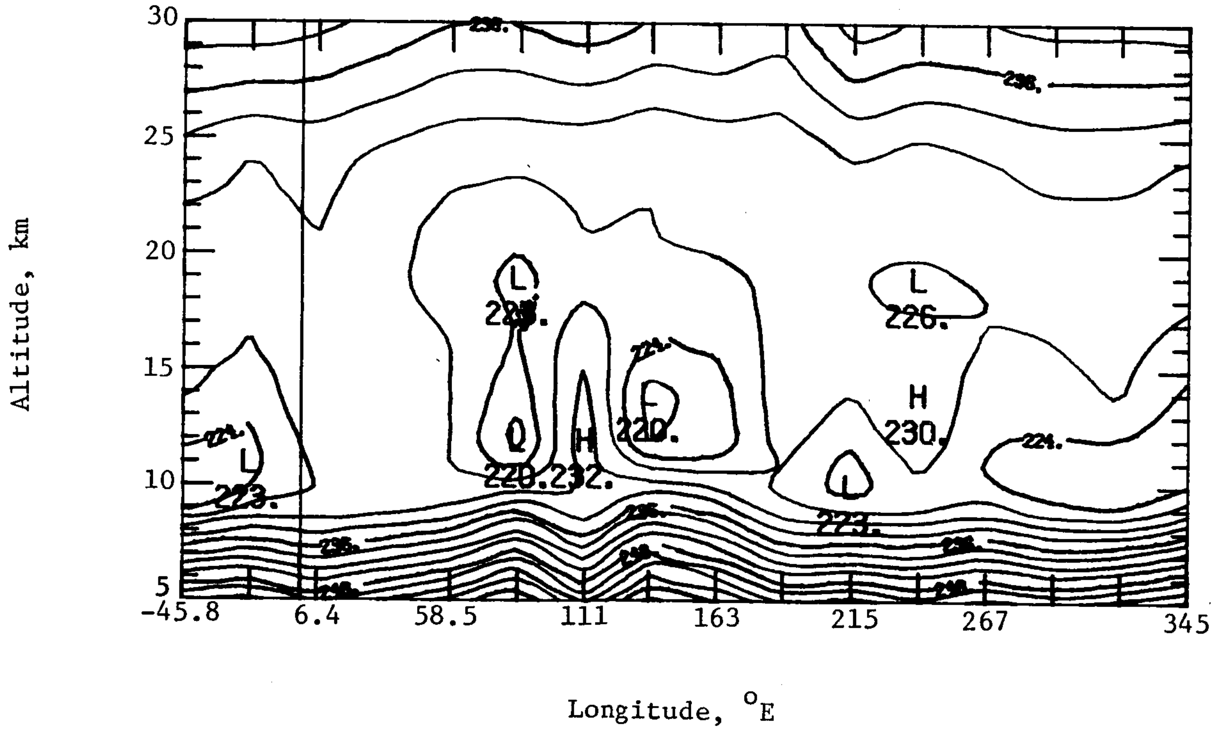


(b) Temperature contours.

Figure 19.- Arctic extinction isopleth and temperature contours for June 15.05 to 16.14, 1982, at latitudes from 66.2° to 66.1° N corresponding to orbits 18 378 to 18 393.

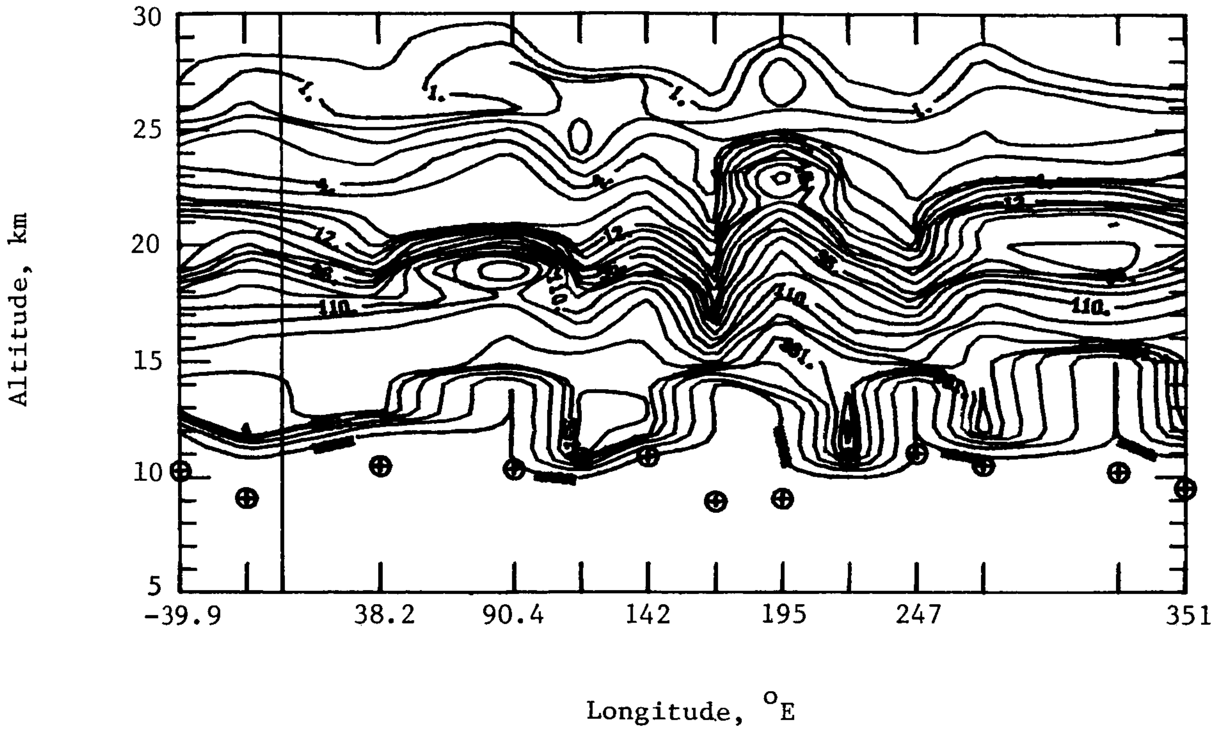


(a) Extinction isopleth.

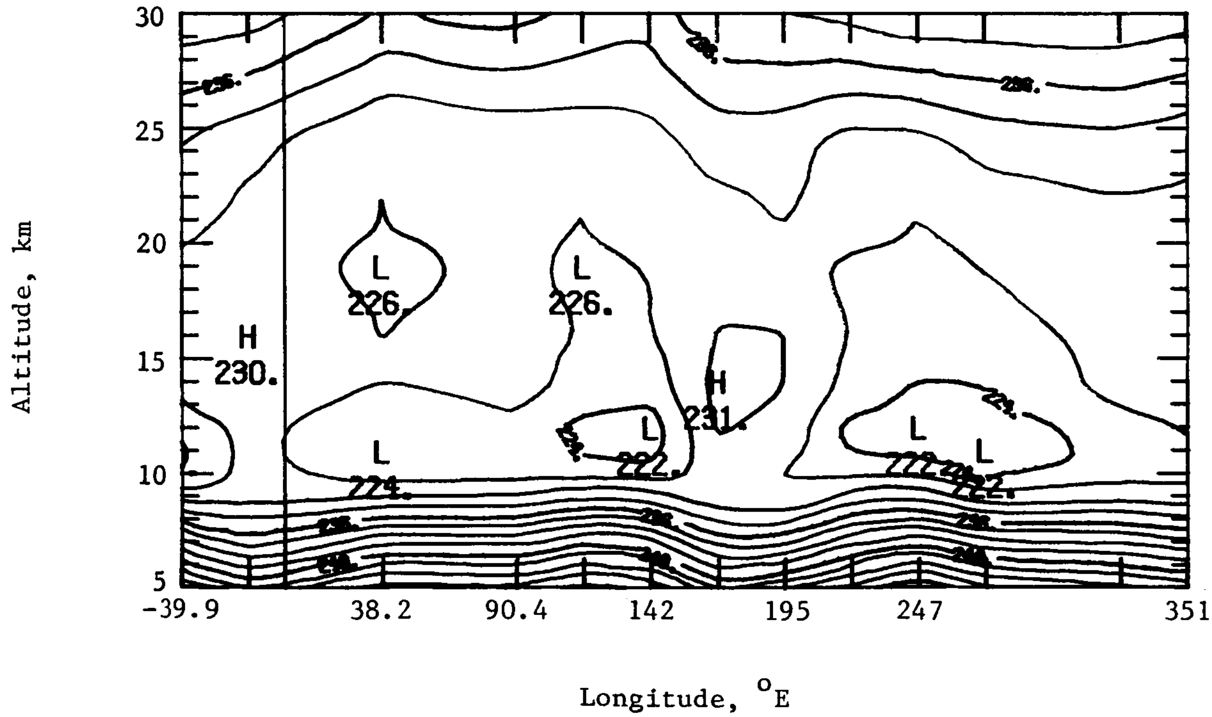


(b) Temperature contours.

Figure 20.- Arctic extinction isopleth and temperature contours for June 22.07 to 23.16, 1982, at a latitude of 66.1° N corresponding to orbits 18 475 to 18 490.

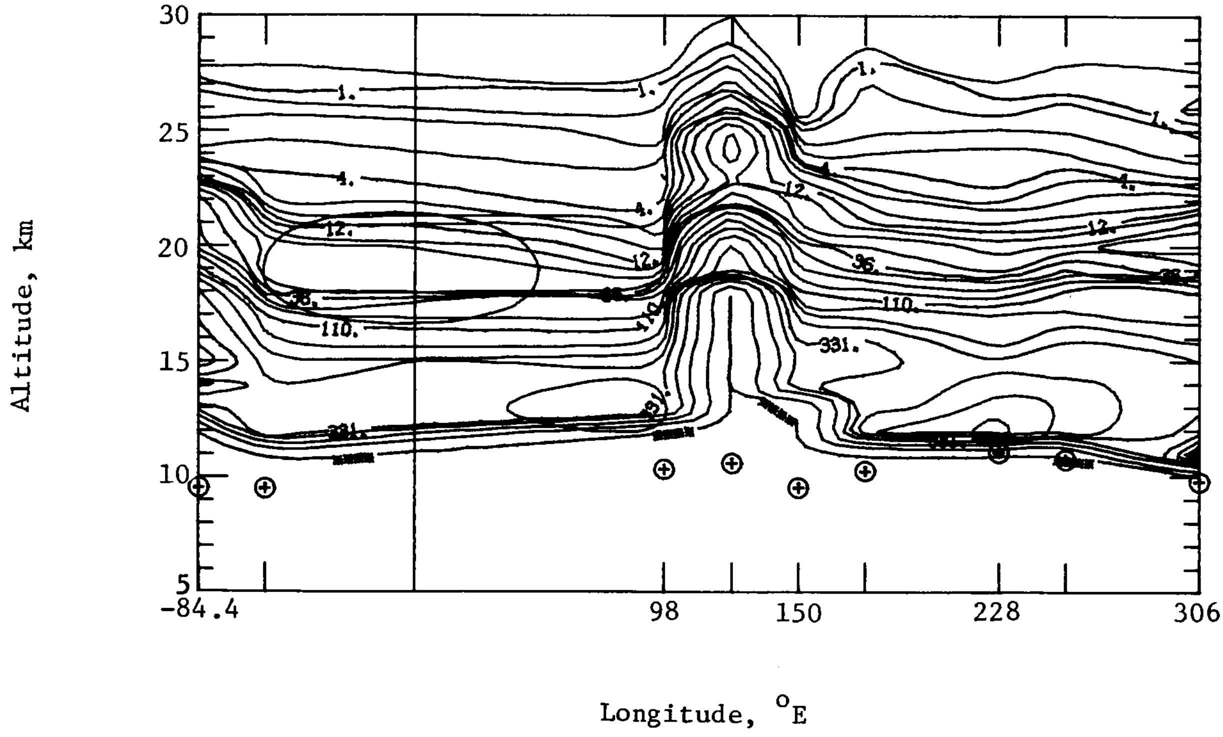


(a) Extinction isopleth.

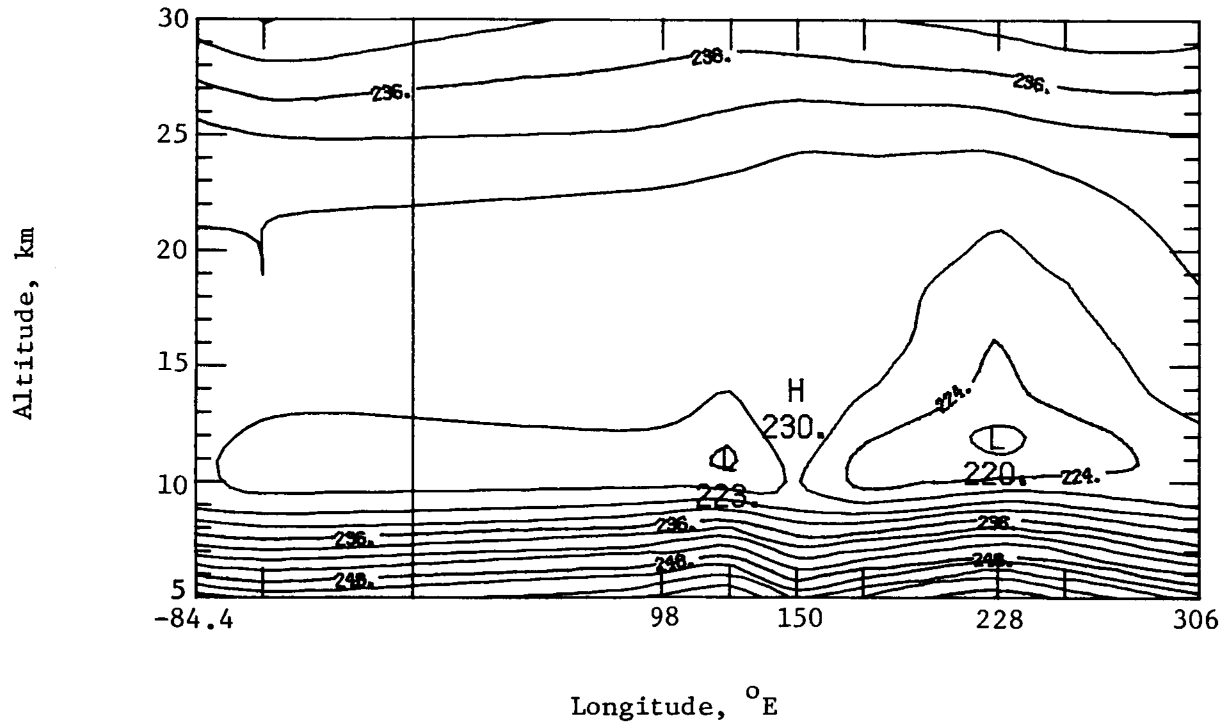


(b) Temperature contours.

Figure 21.- Arctic extinction isopleth and temperature contours for July 2.06 to 3.14, 1982, at latitudes from 66.5° to 66.6° N corresponding to orbits 18 613 to 18 628.

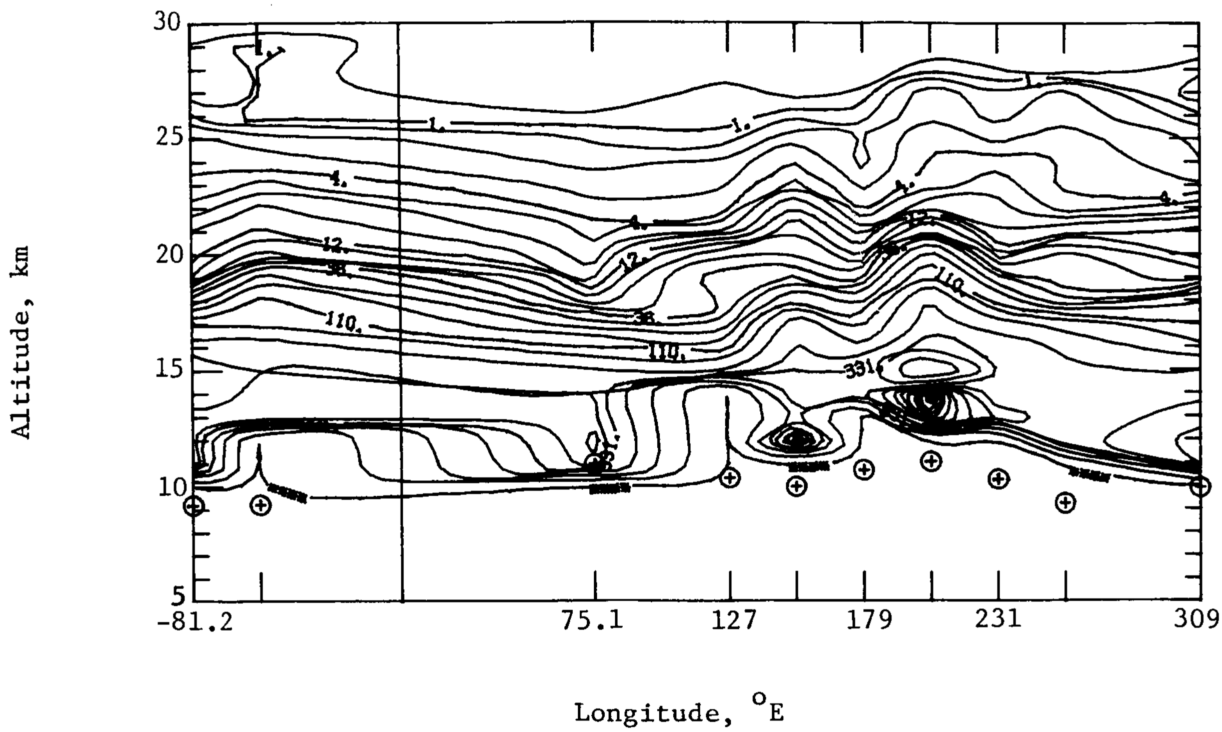


(a) Extinction isopleth.

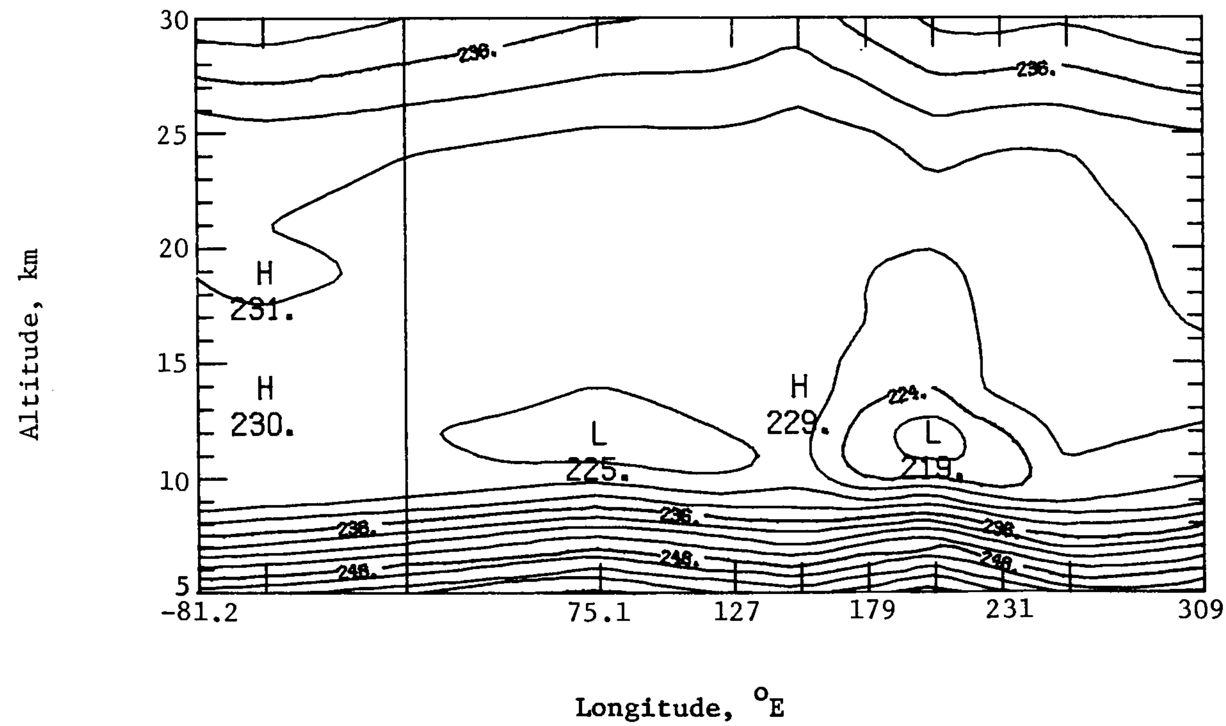


(b) Temperature contours.

Figure 22.- Arctic extinction isopleth and temperature contours for July 6.18 to 7.26, 1982, at latitudes from 66.9° to 67.0° N corresponding to orbits 18 670 to 18 685.

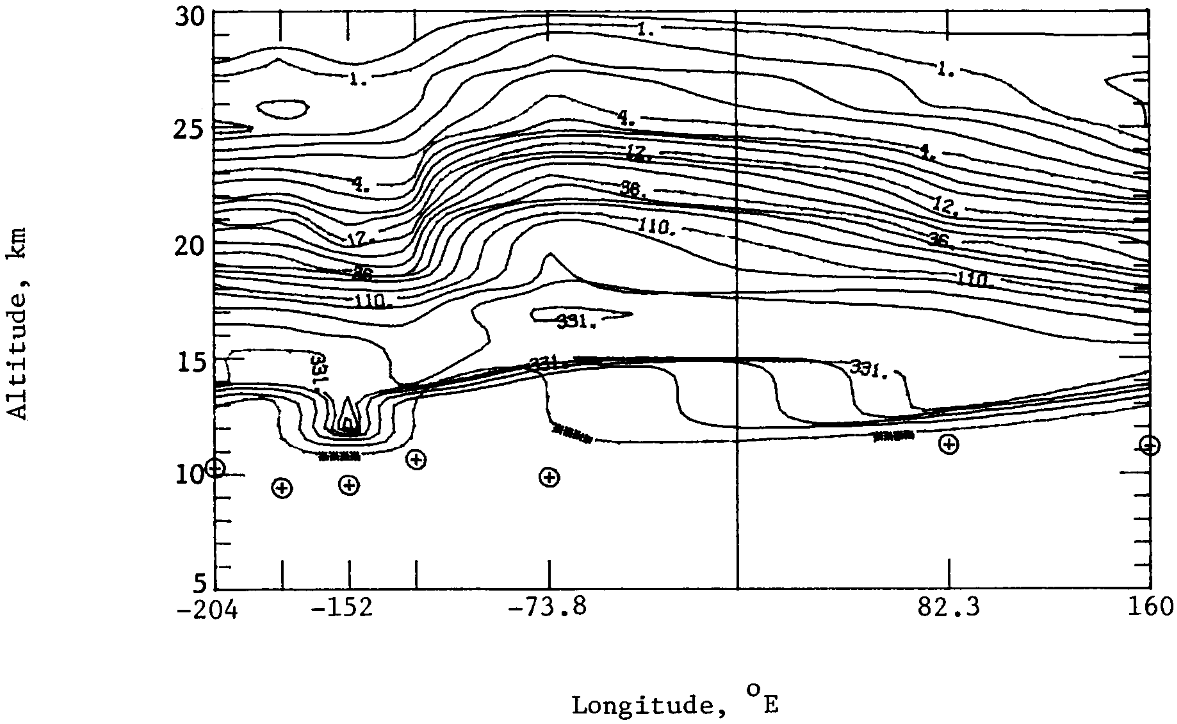


(a) Extinction isopleth.

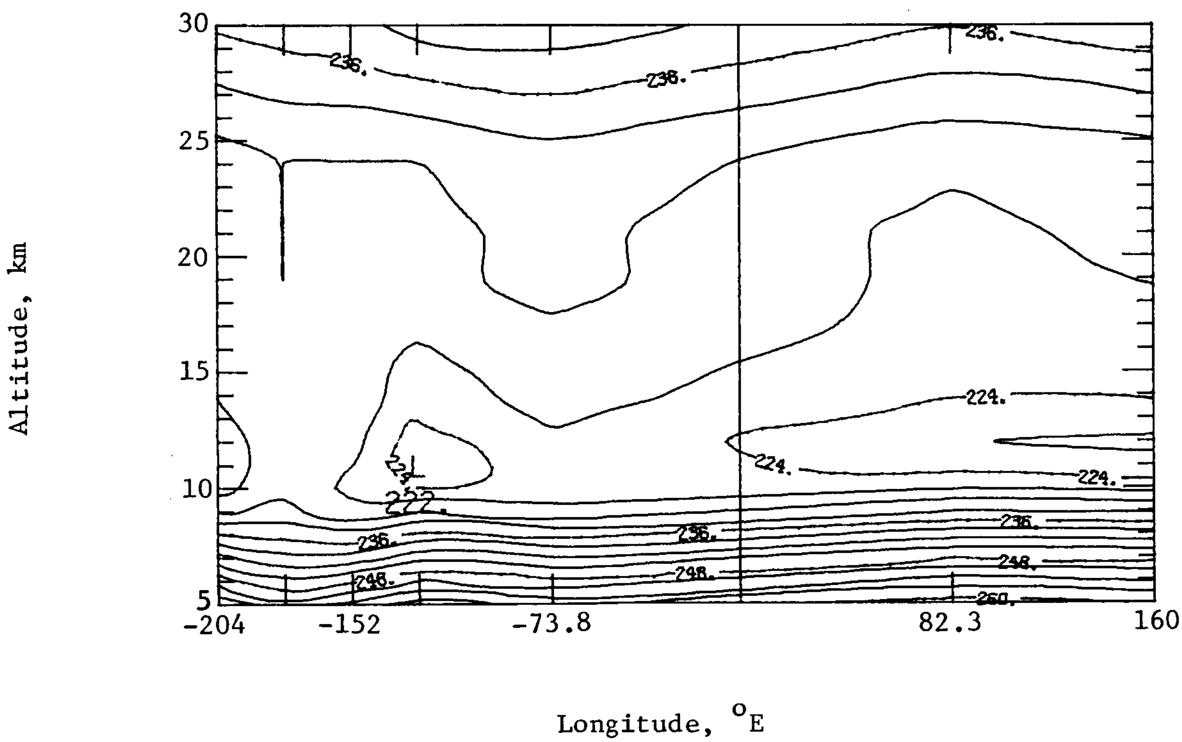


(b) Temperature contours.

Figure 23.- Arctic extinction isopleth and temperature contours for July 11.17 to 12.26, 1982, at latitudes from 67.4° to 67.6° N corresponding to orbits 18 739 to 18 754.

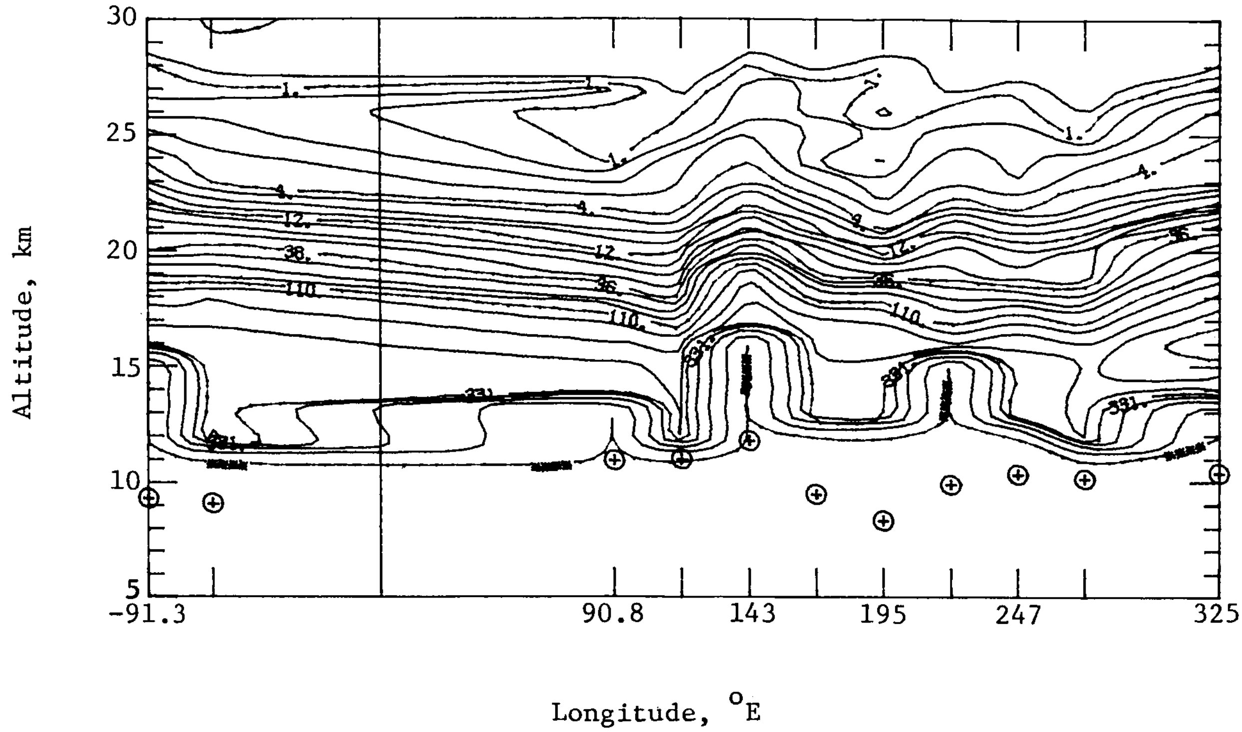


(a) Extinction isopleth.

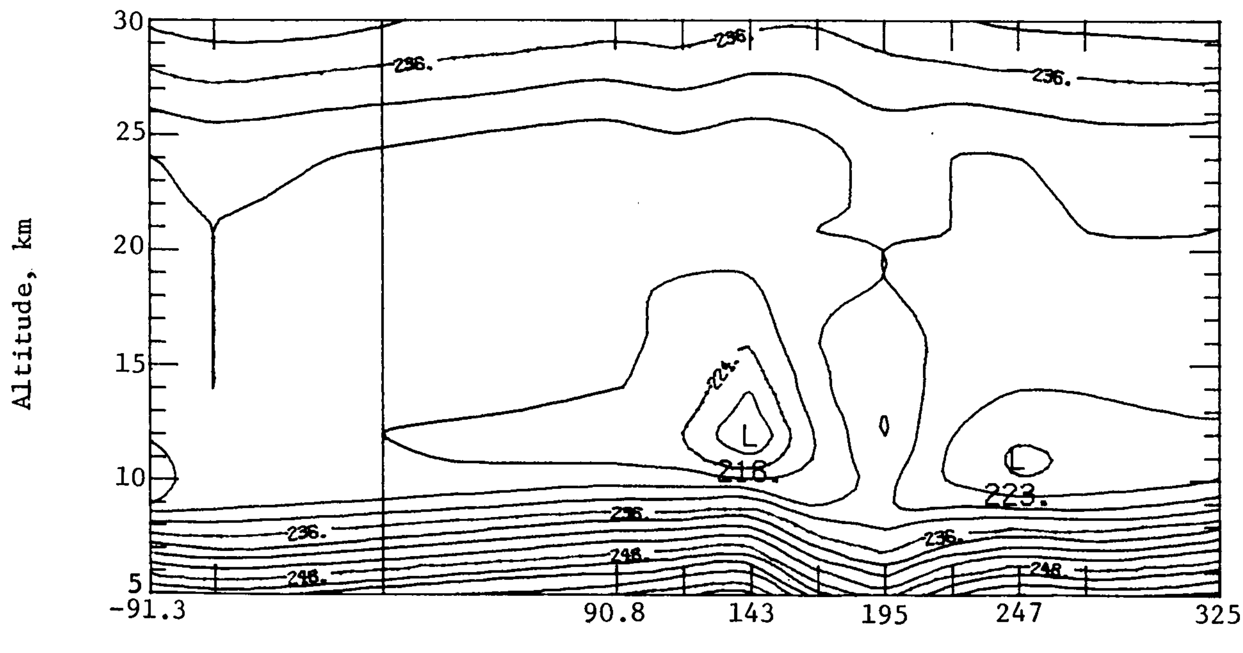


(b) Temperature contours.

Figure 24.- Arctic extinction isopleth and temperature contours for July 21.59 to 22.60, 1982, at latitudes from 69.1° to 69.3° N corresponding to orbits 18 883 to 18 897.

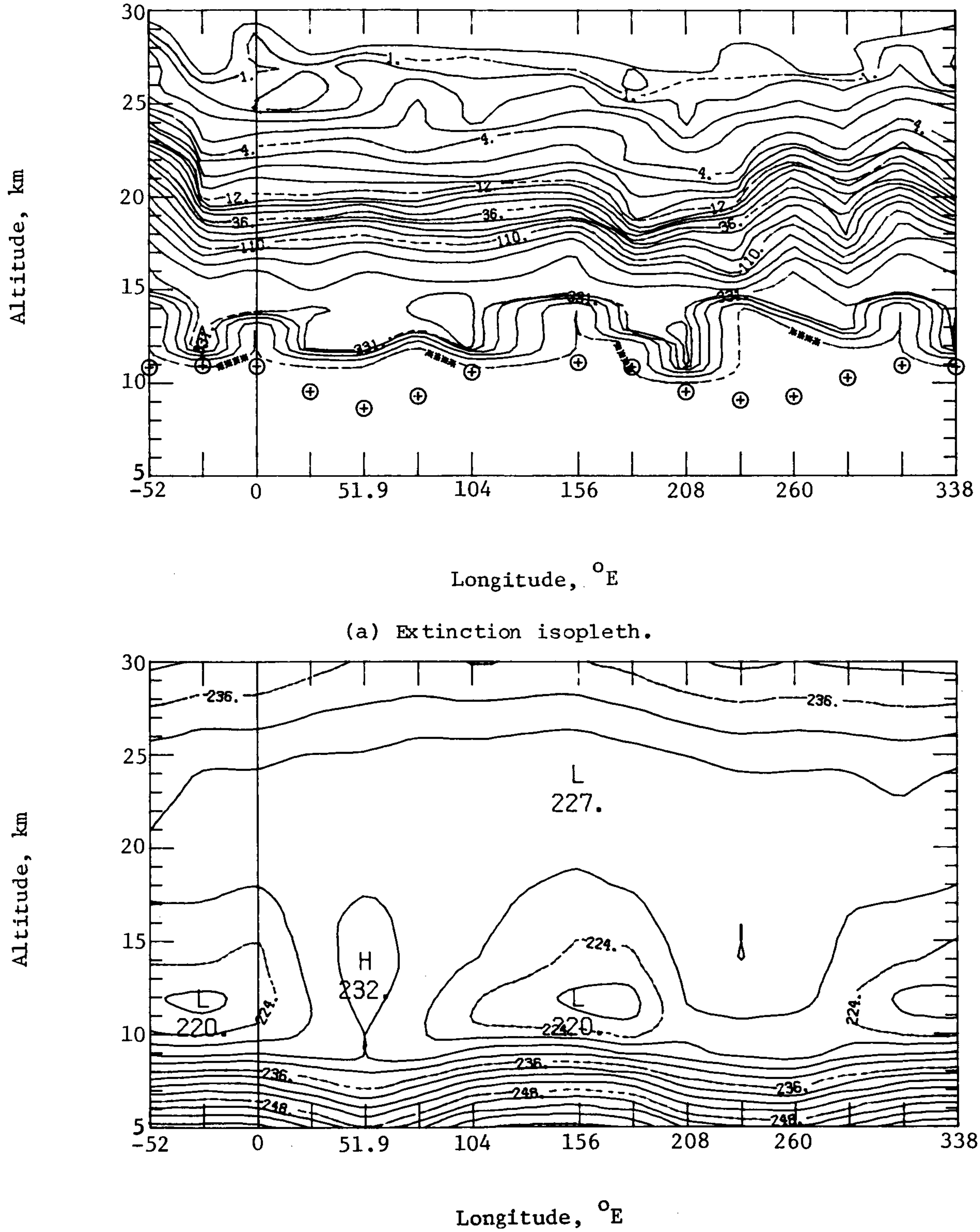


(a) Extinction isopleth.



(b) Temperature contours.

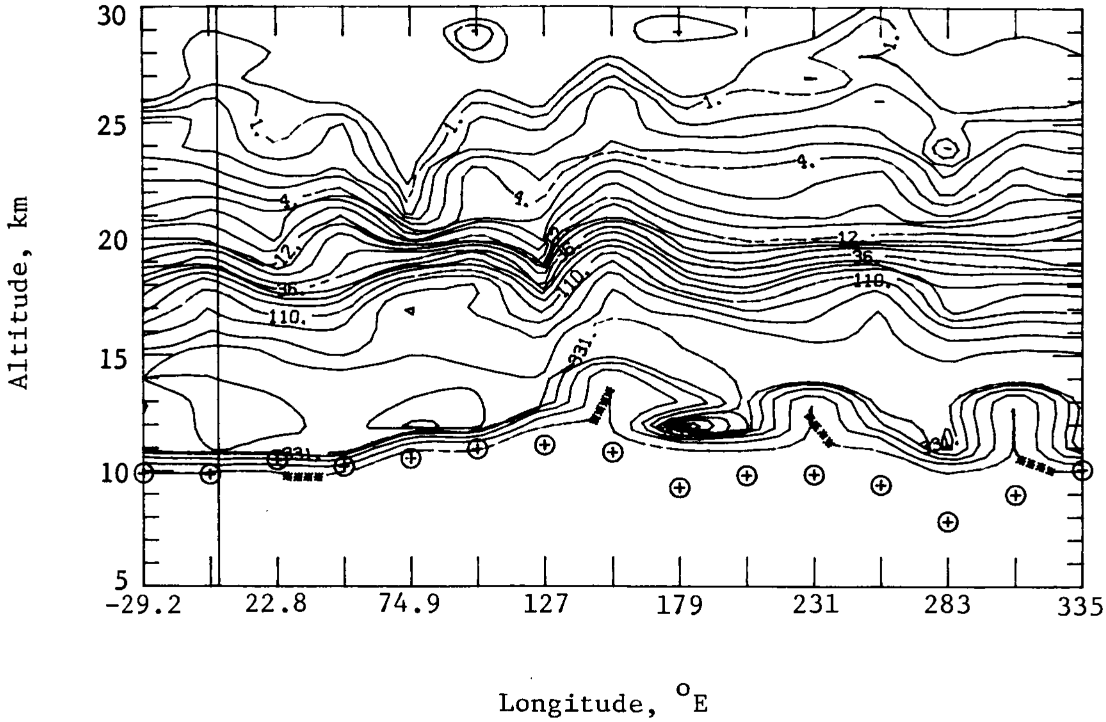
Figure 25.- Arctic extinction isopleth and temperature contours for July 25.13 to 26.29, 1982, at latitudes from 69.8° to 70.0° N corresponding to orbits 18 932 to 18 948.



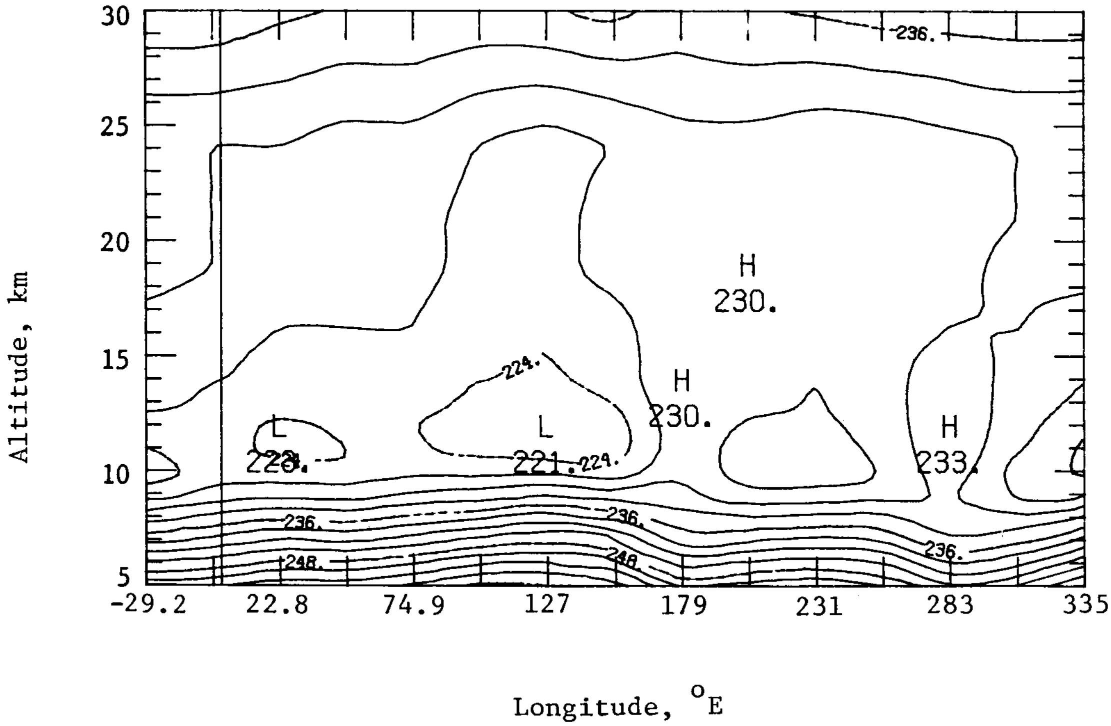
(a) Extinction isopleth.

(b) Temperature contours.

Figure 26.- Arctic extinction isopleth and temperature contours for August 3.10 to 4.19, 1982, at latitudes from 71.7° to 72.0° N corresponding to orbits 19 056 to 19 071.

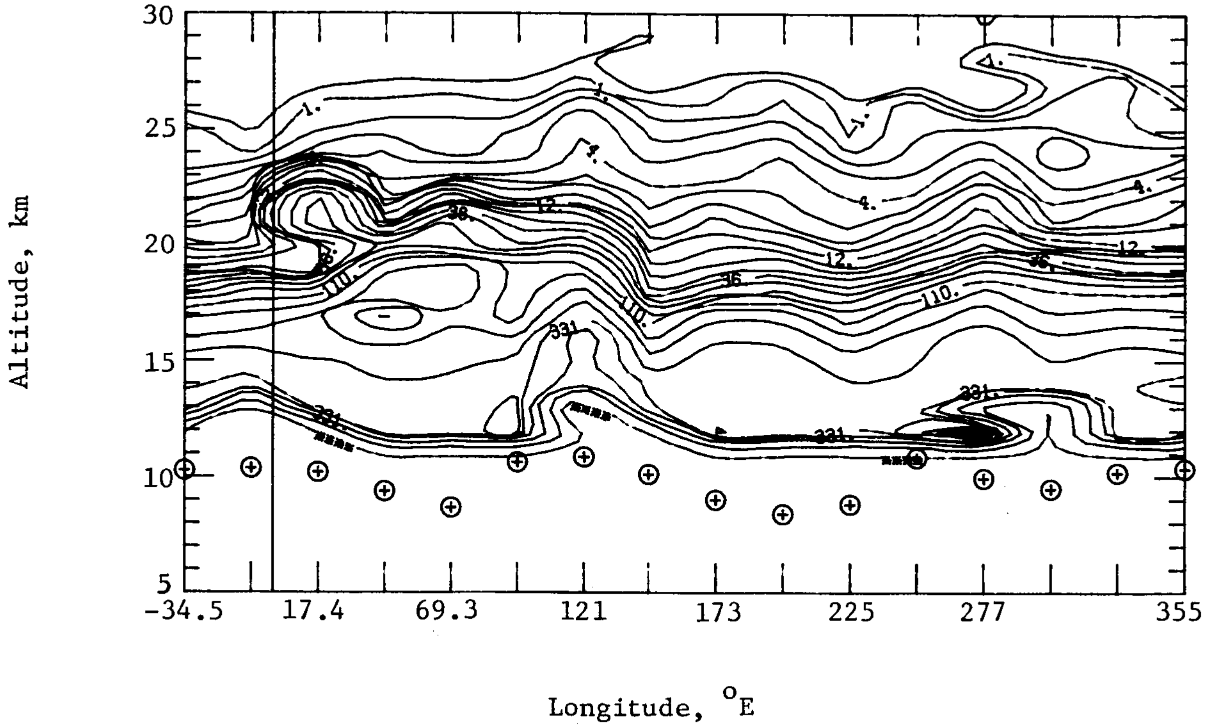


(a) Extinction isopleth.

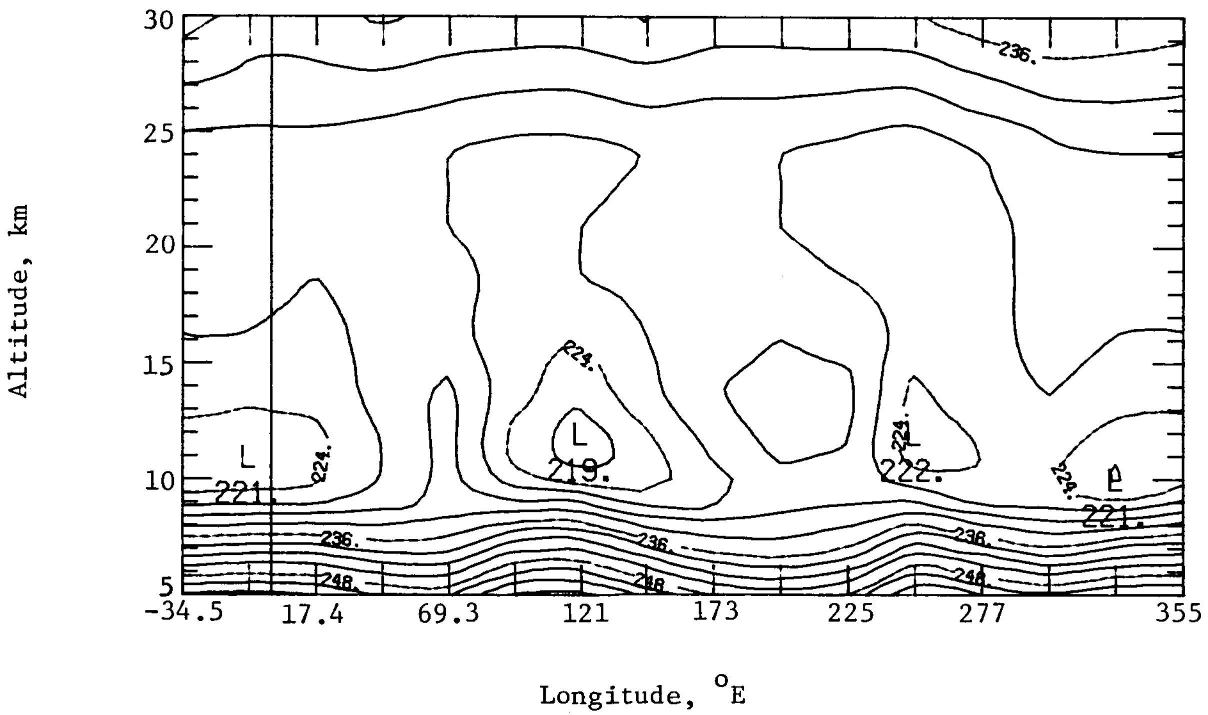


(b) Temperature contours.

Figure 27.- Arctic extinction isopleth and temperature contours for August 10.12 to 11.13, 1982, at latitudes from 73.4° to 73.7° N corresponding to orbits 19 153 to 19 167.

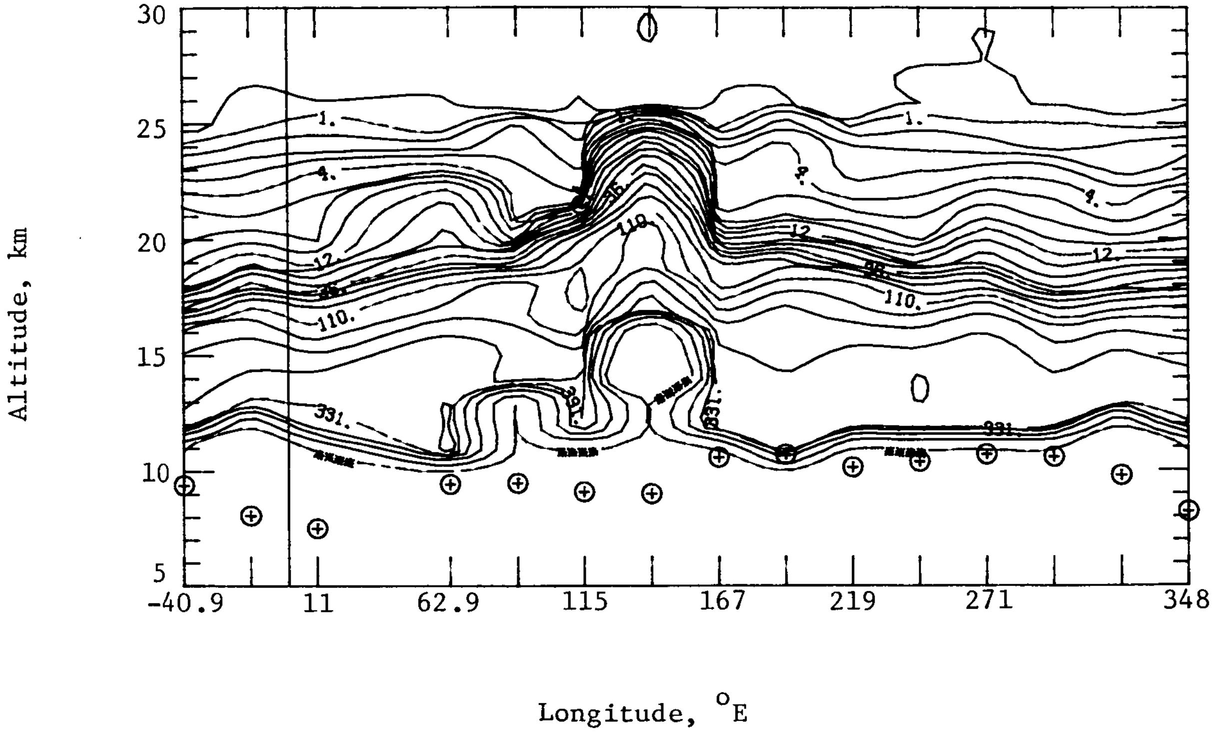


(a) Extinction isopleth.

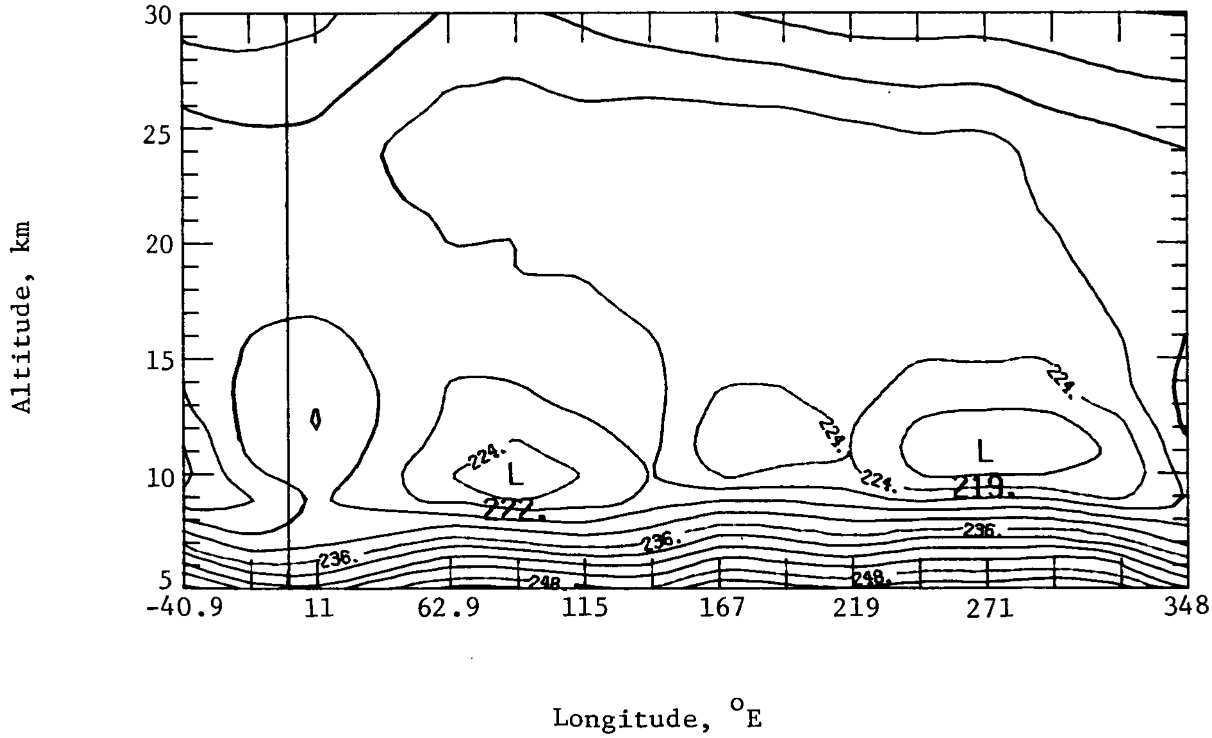


(b) Temperature contours.

Figure 28.- Arctic extinction isopleth and temperature contours for August 18.08 to 19.16, 1982, at latitudes from 75.5° to 75.8° N corresponding to orbits 19 263 to 19 278.

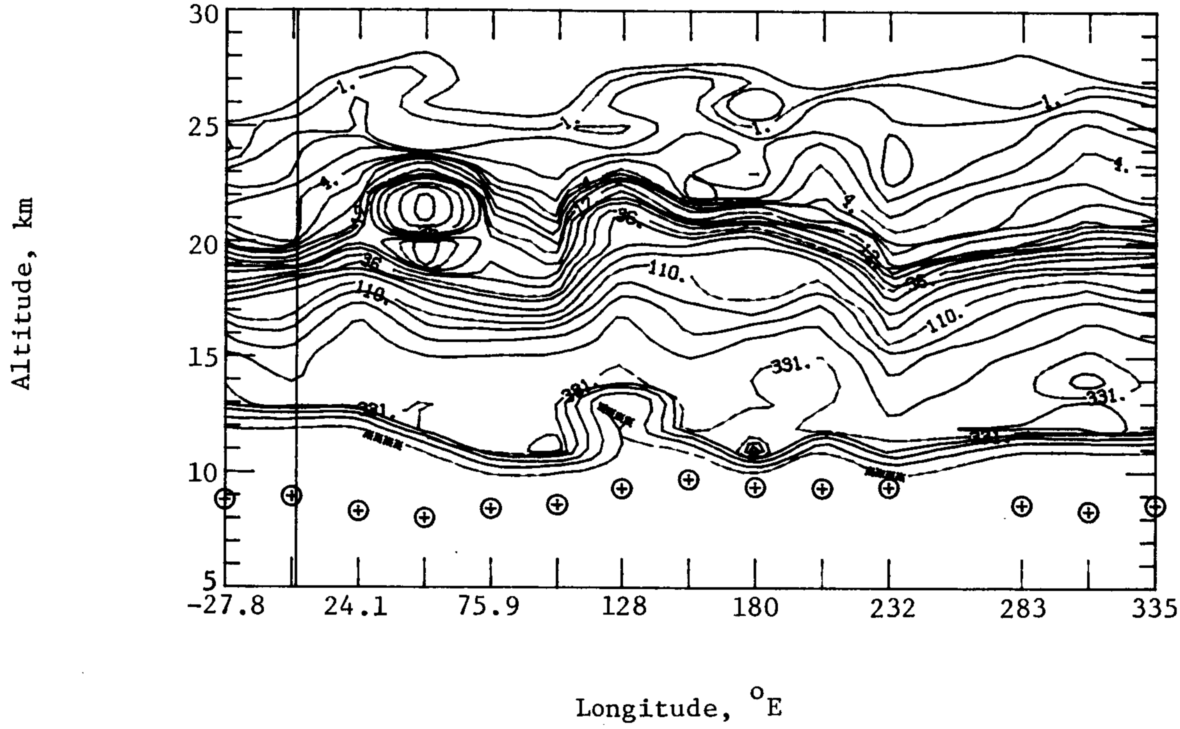


(a) Extinction isopleth.

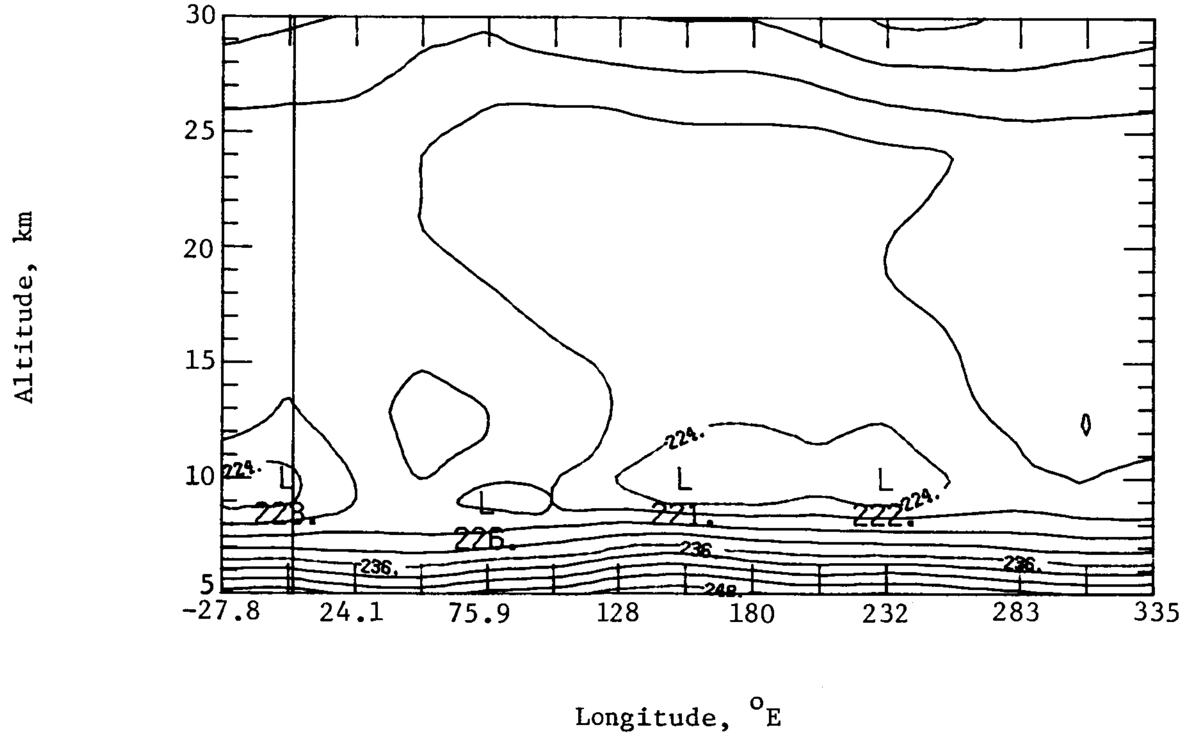


(b) Temperature contours.

Figure 29.- Arctic extinction isopleth and temperature contours for August 27.12 to 28.21, 1982, at latitudes from 77.8° to 78.1° N corresponding to orbits 19 388 to 19 403.

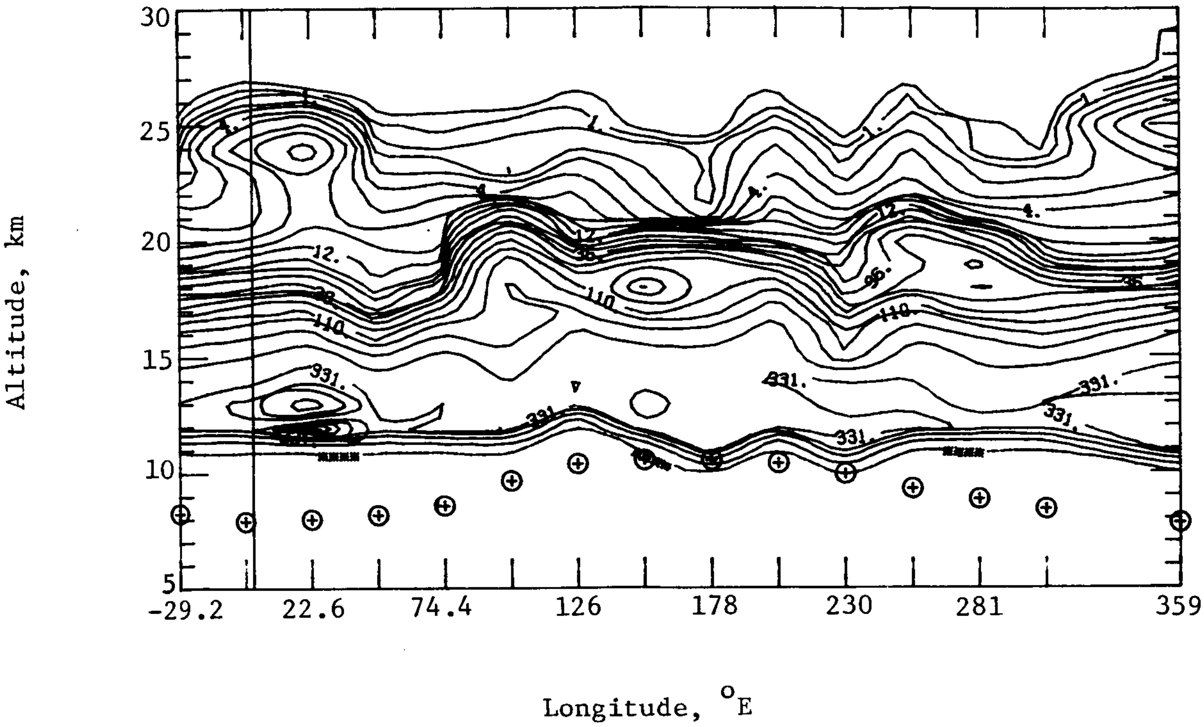


(a) Extinction isopleth.

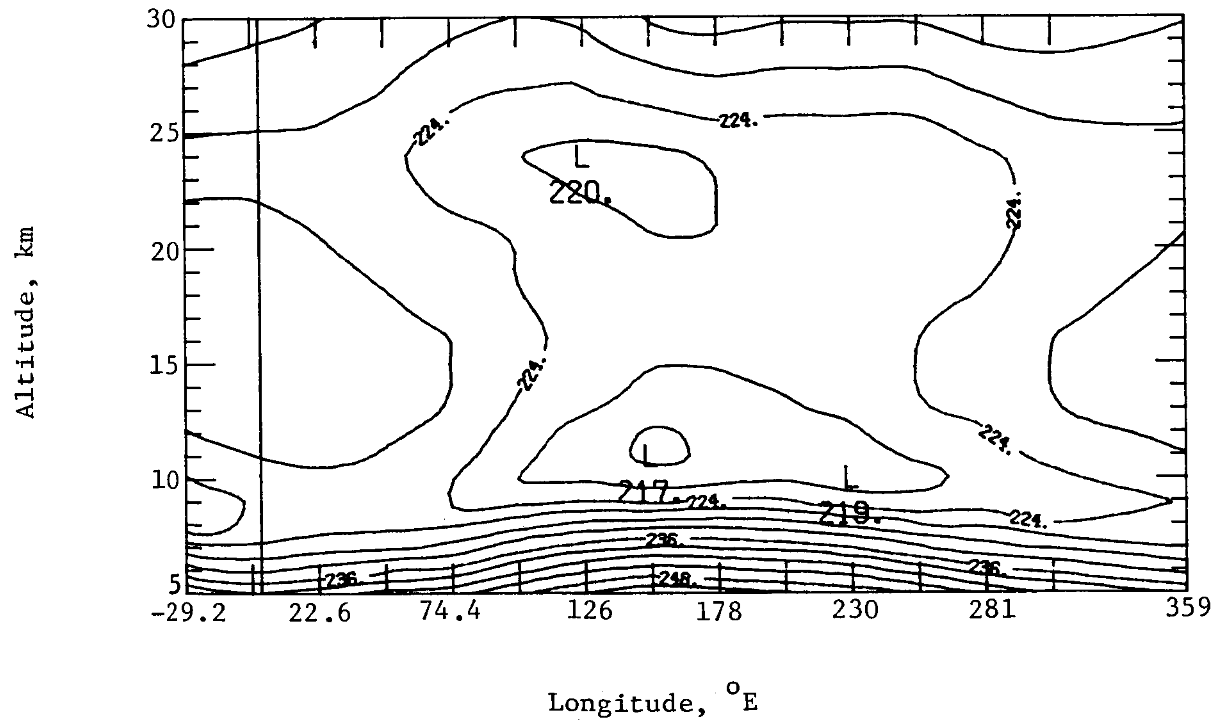


(b) Temperature contours.

Figure 30.- Arctic extinction isopleth and temperature contours for August 31.17 to September 1.19, 1982, at latitudes from 78.8° to 79.0° N corresponding to orbits 19 444 to 19 458.

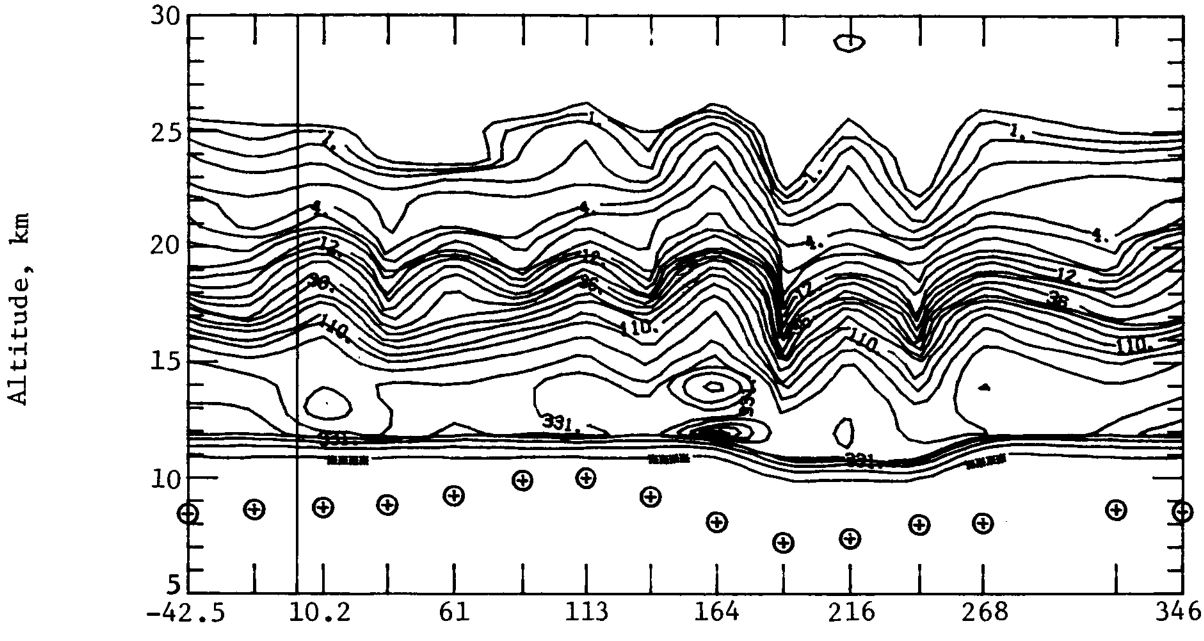


(a) Extinction isopleth.

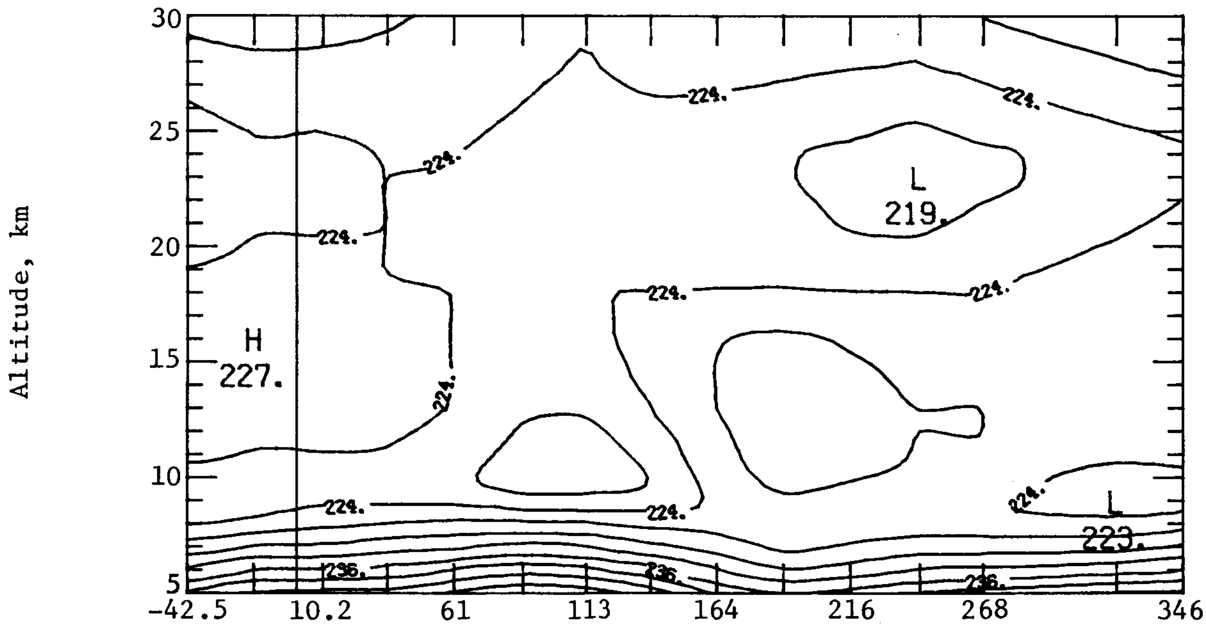


(b) Temperature contours.

Figure 31.- Arctic extinction isopleth and temperature contours for September 10.16 to 11.24, 1982, at latitudes from 80.6° to 80.8° N corresponding to orbits 19 582 to 19 597.

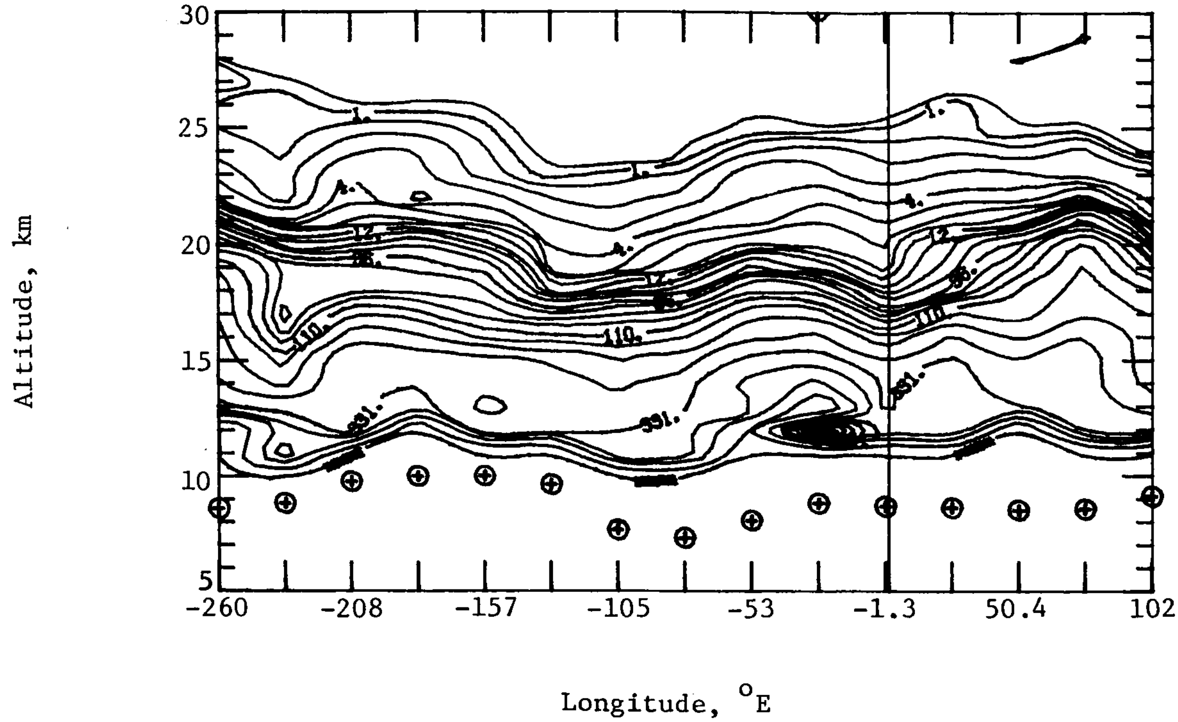


(a) Extinction isopleth.

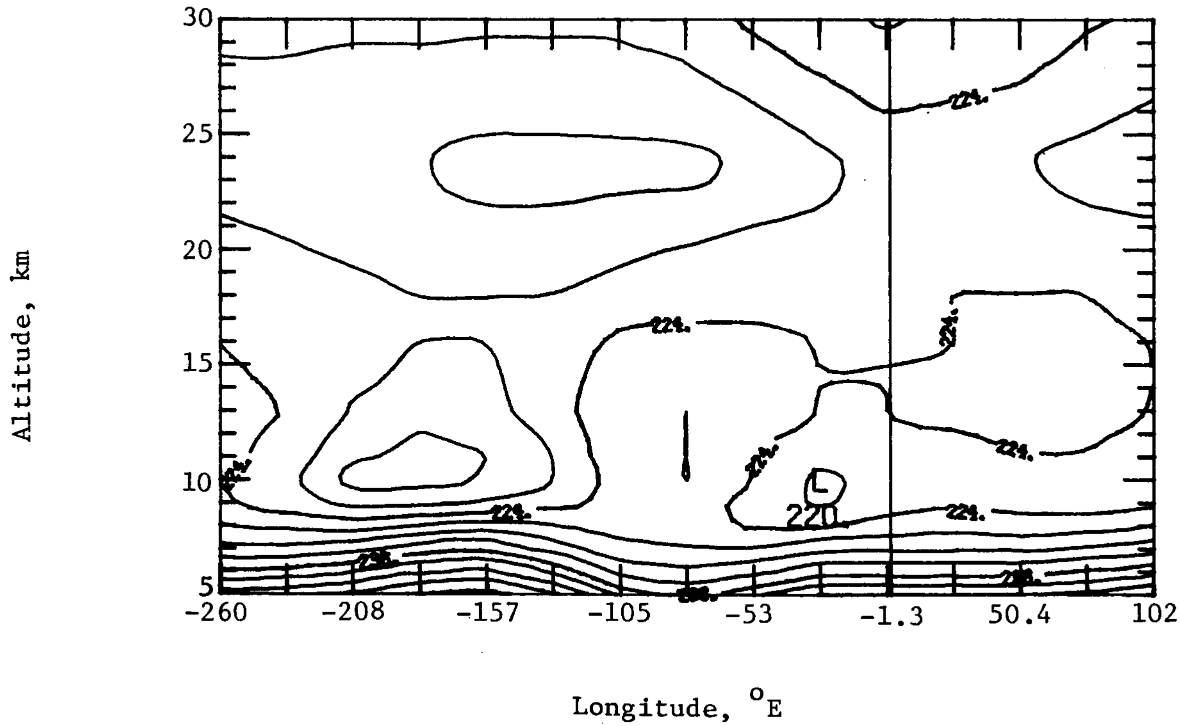


(b) Temperature contours.

Figure 32.- Arctic extinction isopleth and temperature contours for September 16.23 to 17.32, 1982, at a latitude of 81.2° N corresponding to orbits 19 666 to 19 681.

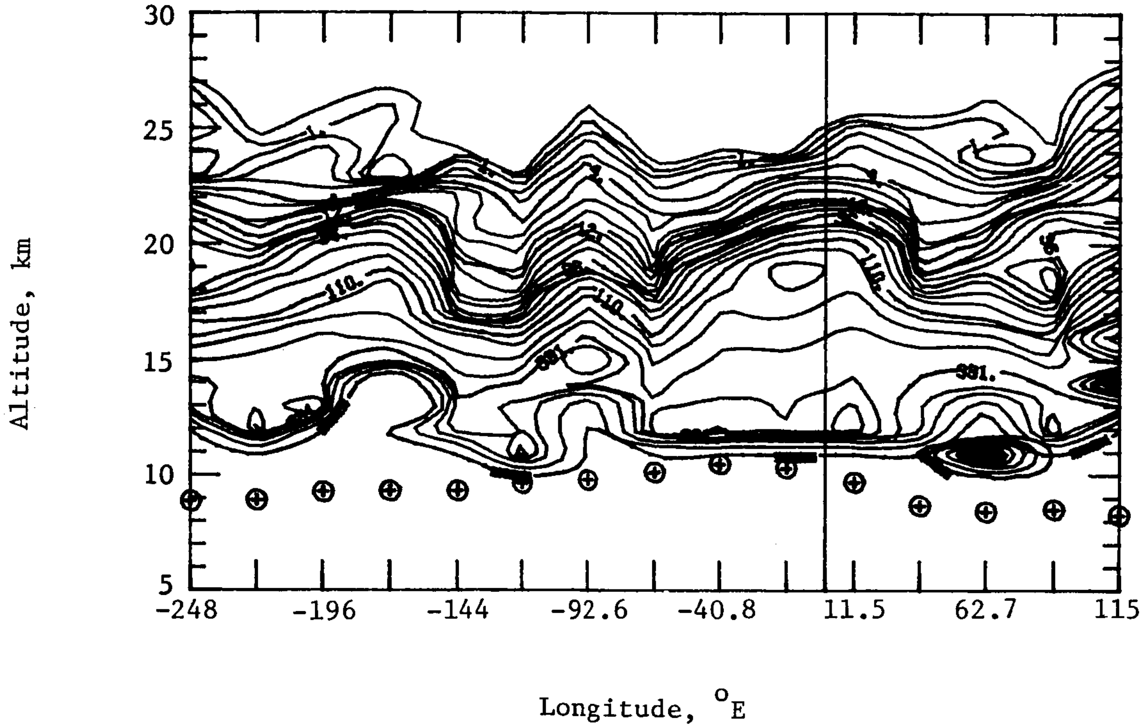


(a) Extinction isopleth.

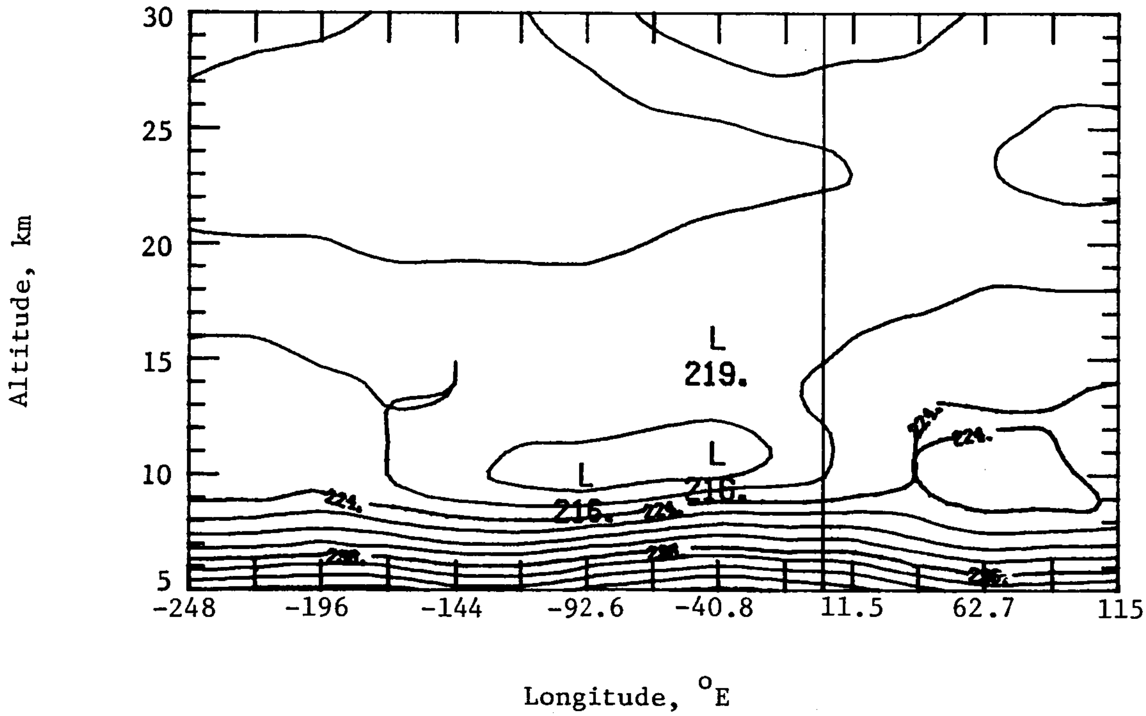


(b) Temperature contours.

Figure 33.- Arctic extinction isopleth and temperature contours for September 21.95 to 22.96, 1982, at latitudes from 81.2° to 81.1° N corresponding to orbits 19 745 to 19 759.

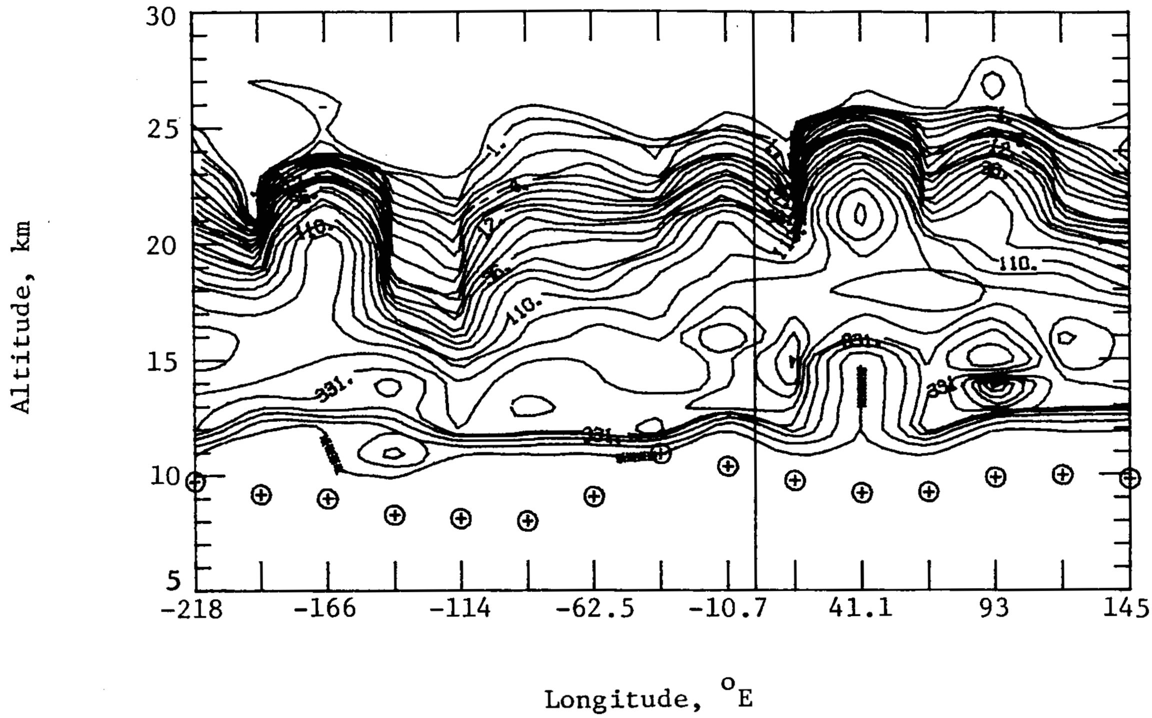


(a) Extinction isopleth.

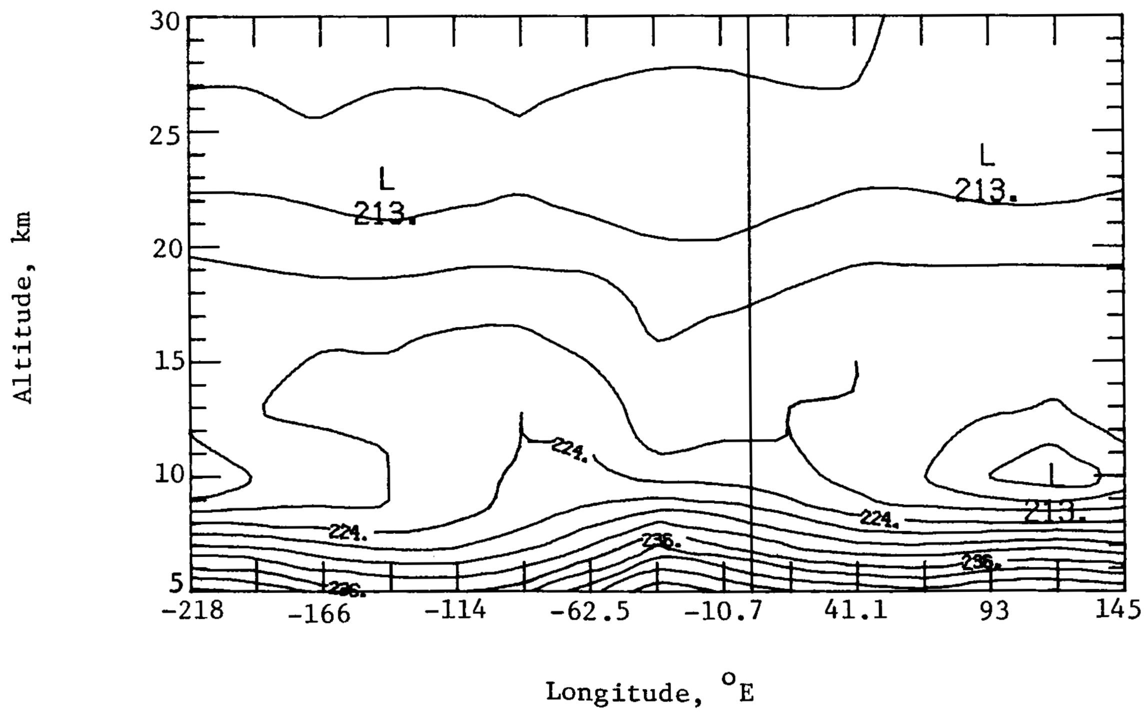


(b) Temperature contours.

Figure 34.- Arctic extinction isopleth and temperature contours for September 27.95 to 28.96, 1982, at latitudes from 80.6° to 80.5° N corresponding to orbits 19 828 to 19 842.

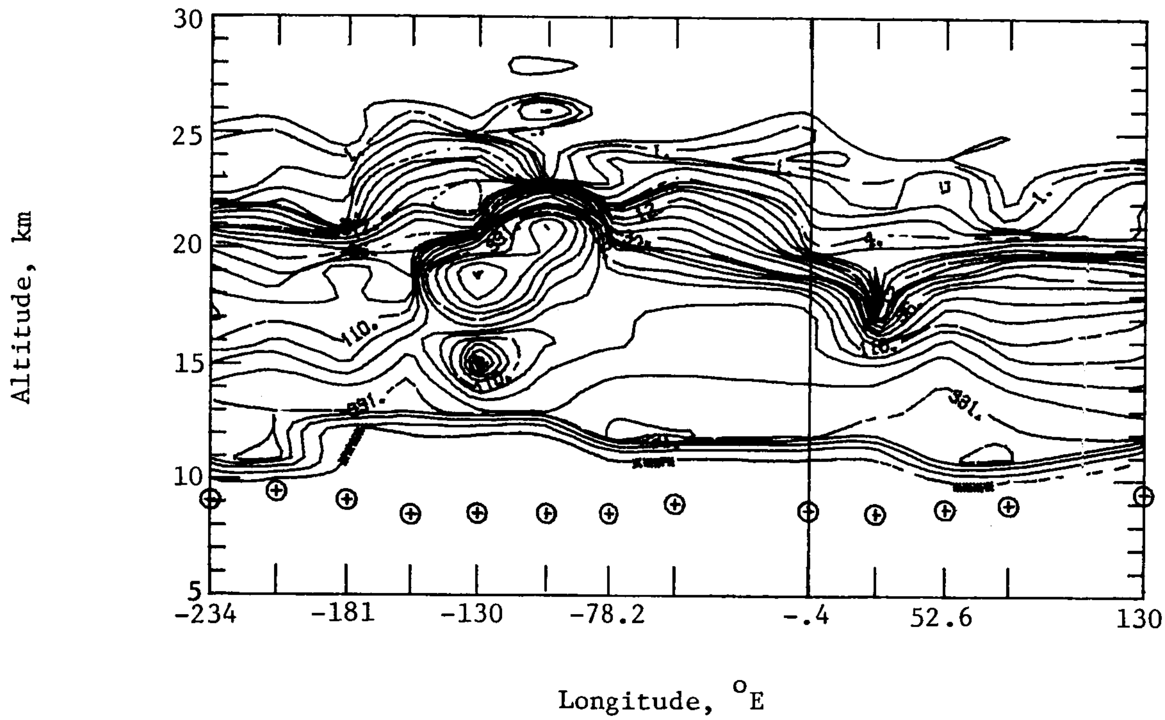


(a) Extinction isopleth.

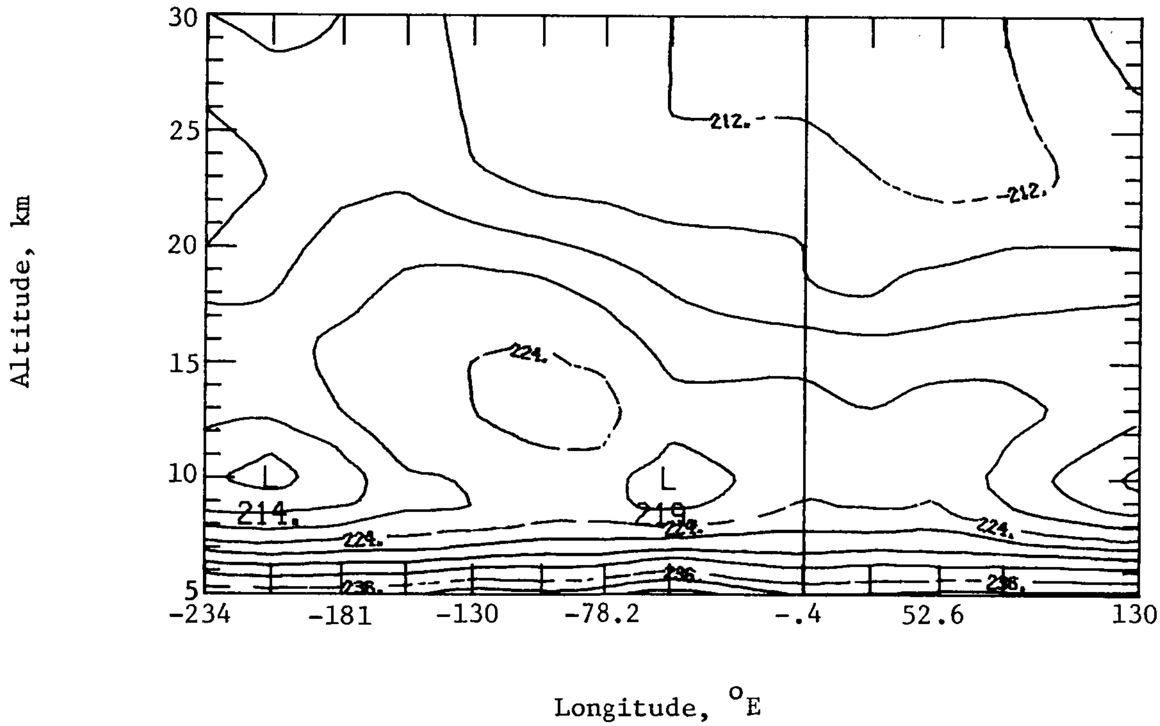


(b) Temperature contours.

Figure 35.- Arctic extinction isopleth and temperature contours for October 5.91 to 6.92, 1982, at latitudes from 79.2° to 79.0° N corresponding to orbits 19 938 to 19 952.

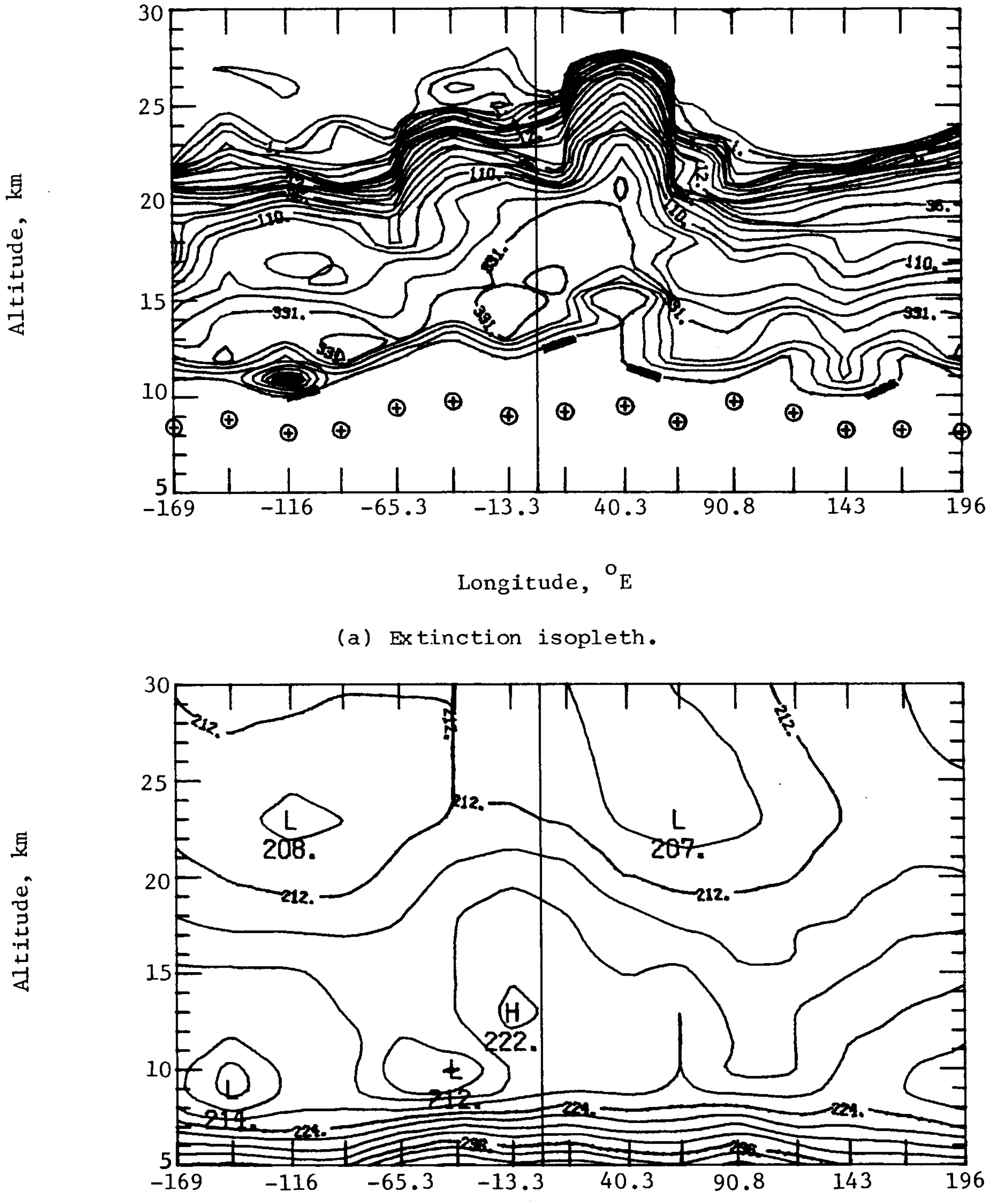


(a) Extinction isopleth.



(b) Temperature contours.

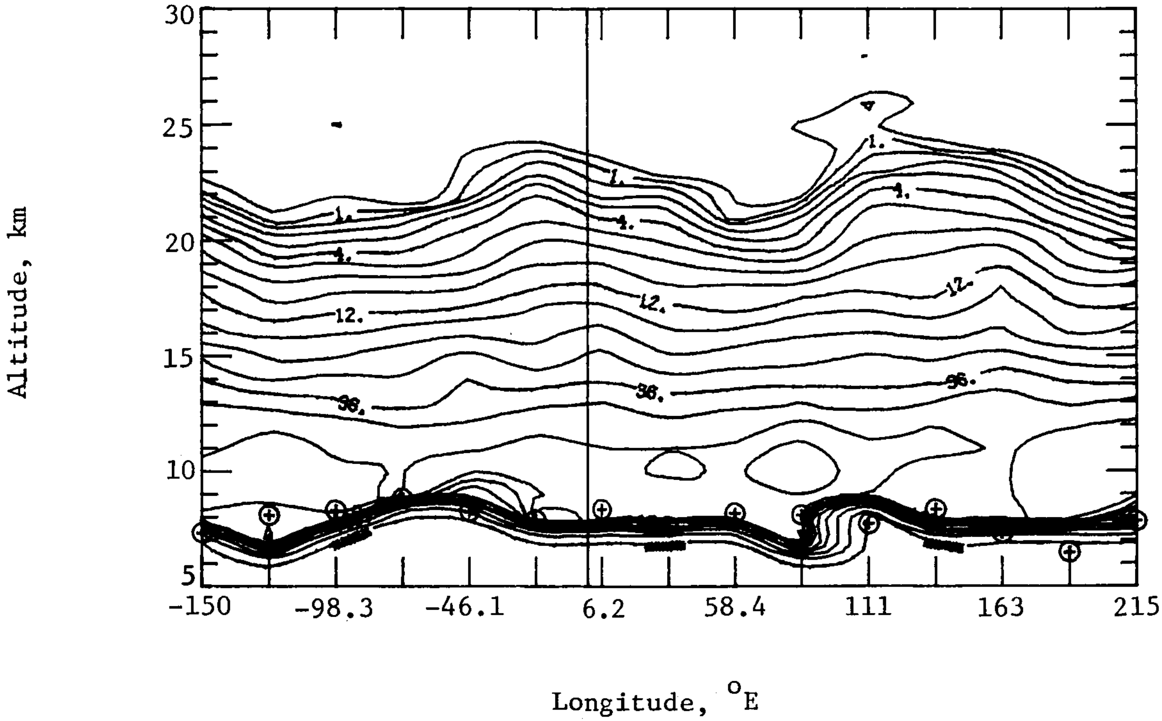
Figure 36.- Arctic extinction isopleth and temperature contours for October 10.97 to 11.99, 1982, at latitudes from 78.2° to 77.8° N corresponding to orbits 20 008 to 20 022.



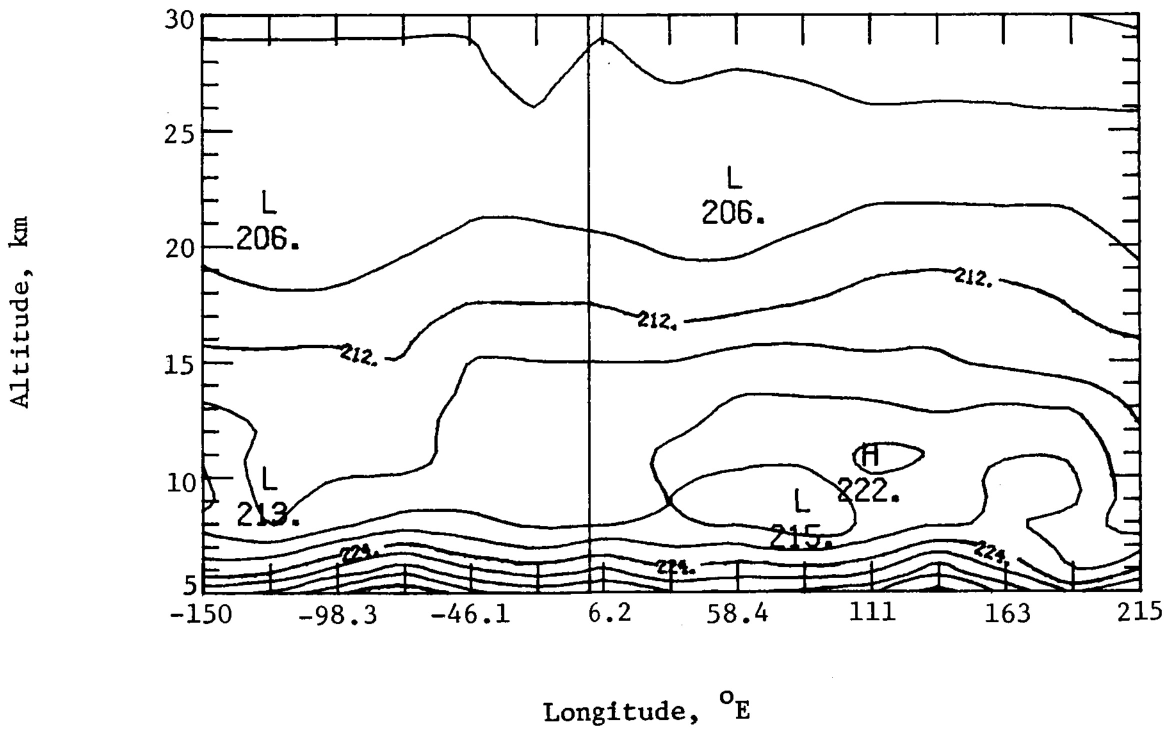
(a) Extinction isopleth.

(b) Temperature contours.

Figure 37.- Arctic extinction isopleth and temperature contours for October 21.82 to 22.84, 1982, at latitudes from 75.6° to 75.1° N corresponding to orbits 20 158 to 20 172.

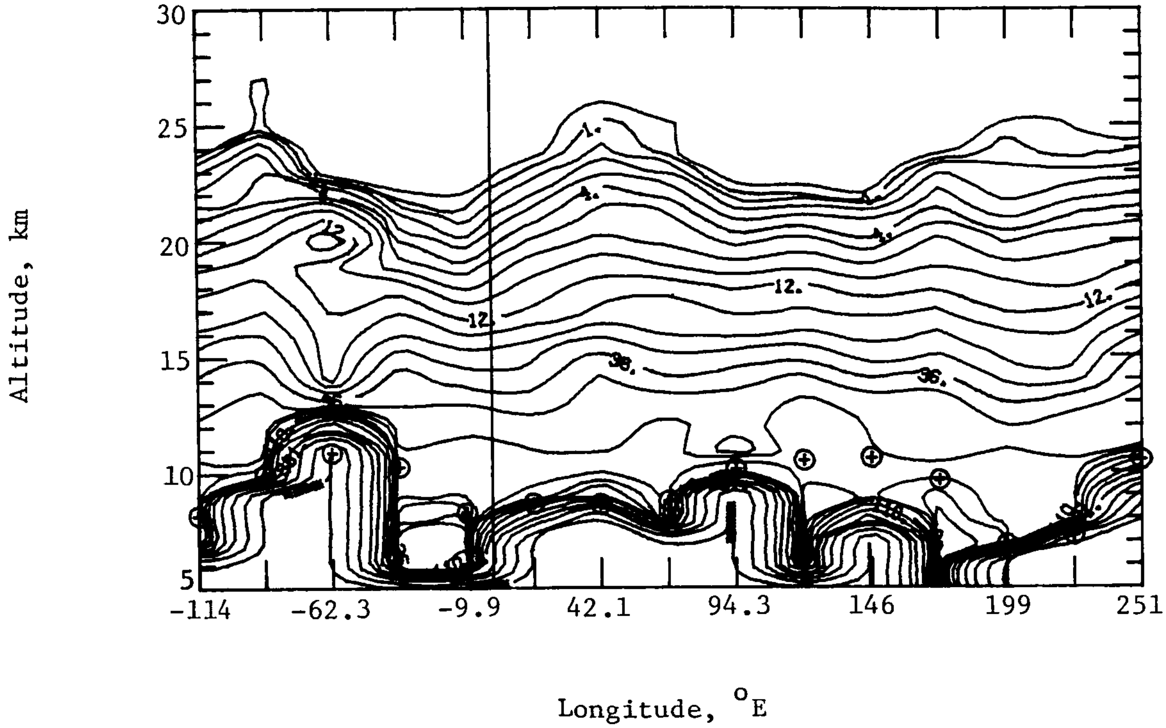


(a) Extinction isopleth.

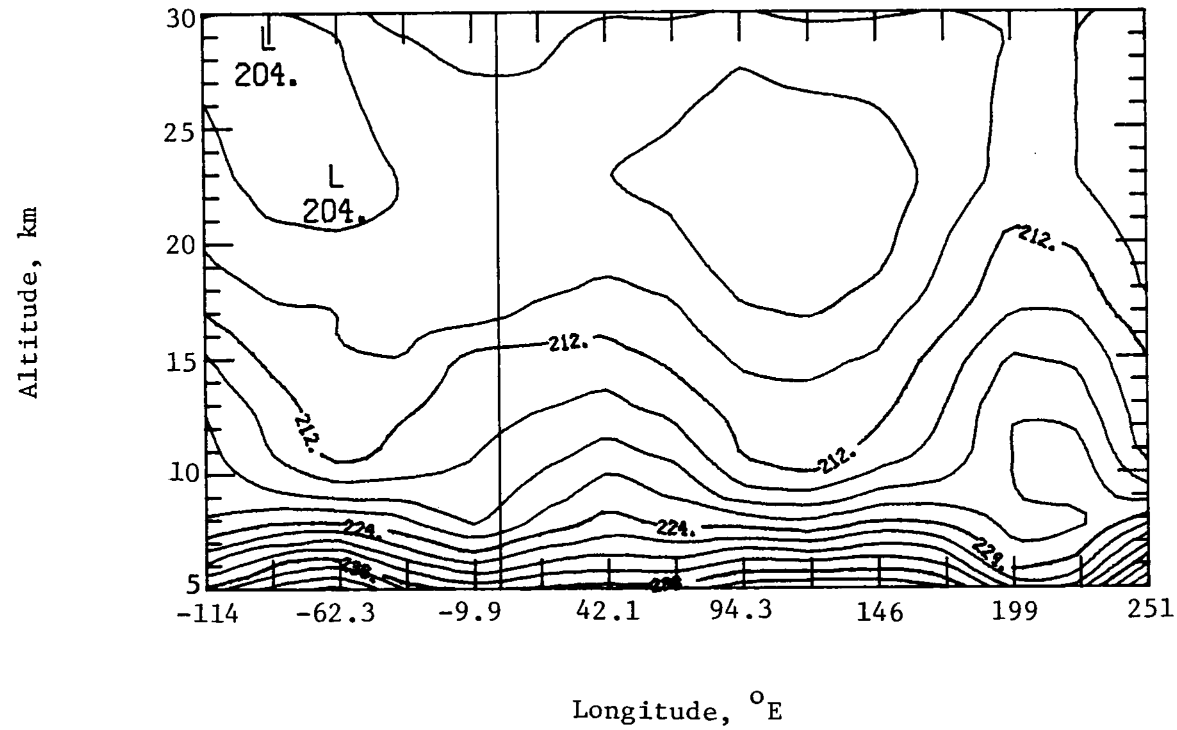


(b) Temperature contours.

Figure 38.- Antarctic extinction isopleth and temperature contours for April 26.01 to 27.02, 1982, at latitudes from 73.3° to 73.0° S corresponding to orbits 17 687 to 17 701.

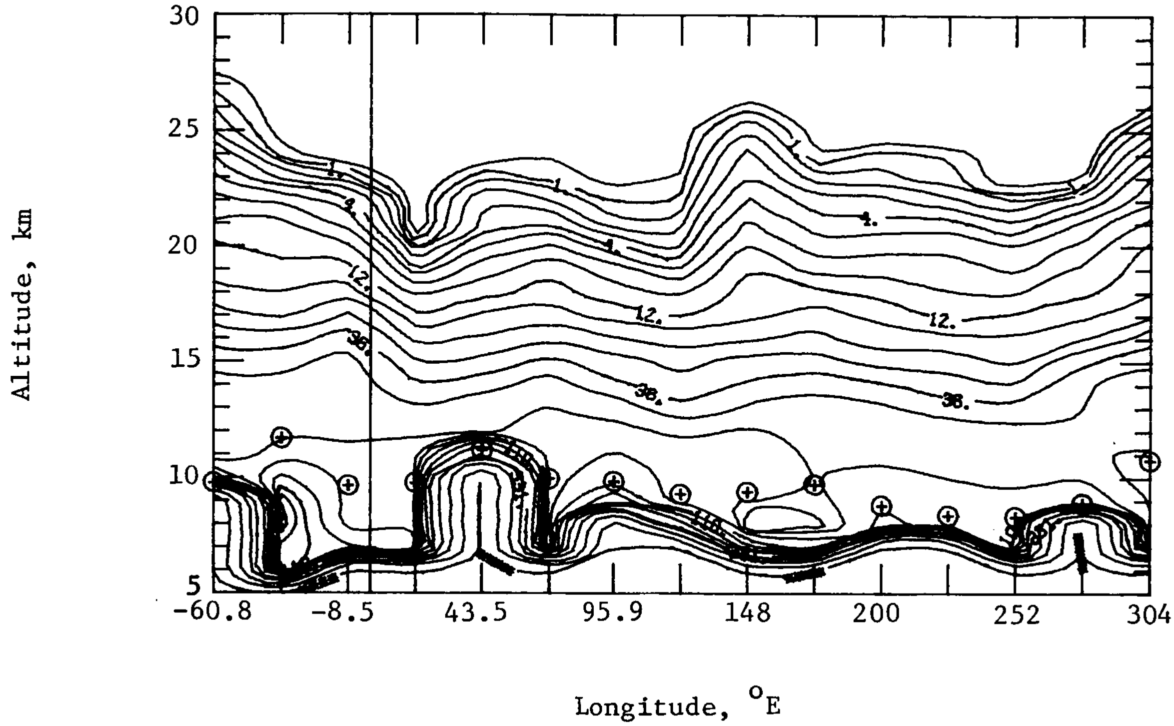


(a) Extinction isopleth.

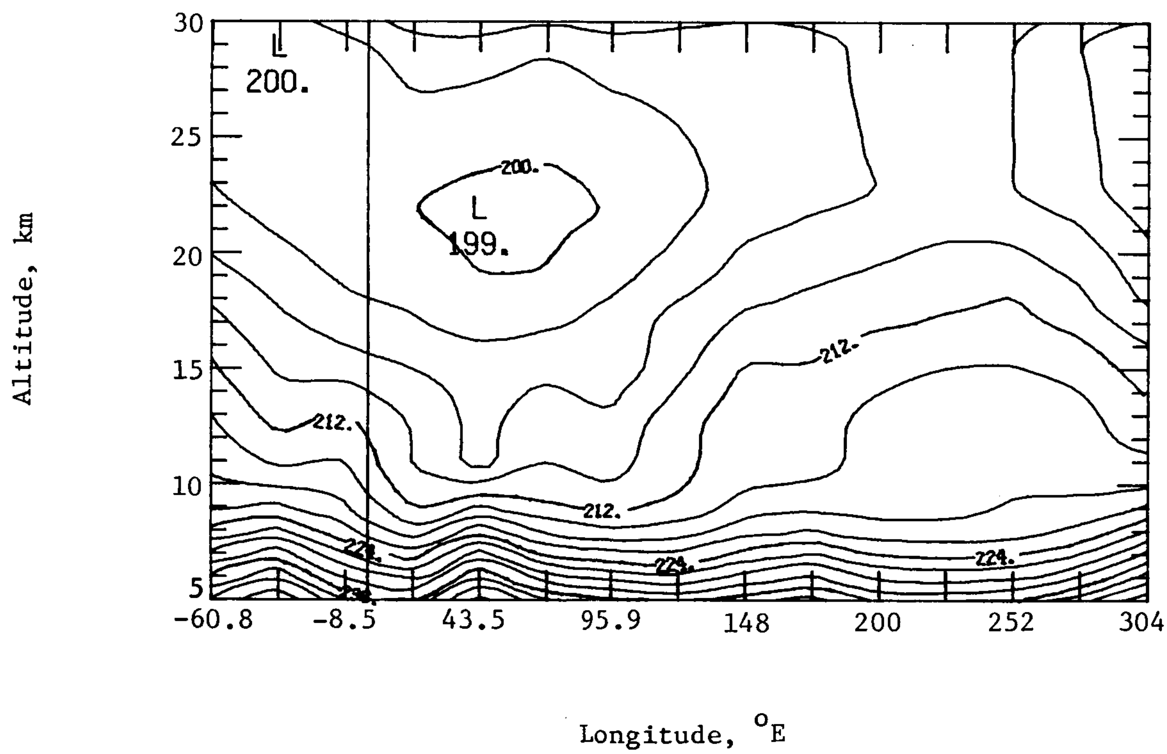


(b) Temperature contours.

Figure 39.- Antarctic extinction isopleth and temperature contours for May 3.90 to 4.91, 1982, at latitudes from 71.4° to 71.1° S corresponding to orbits 17 796 to 17 810.

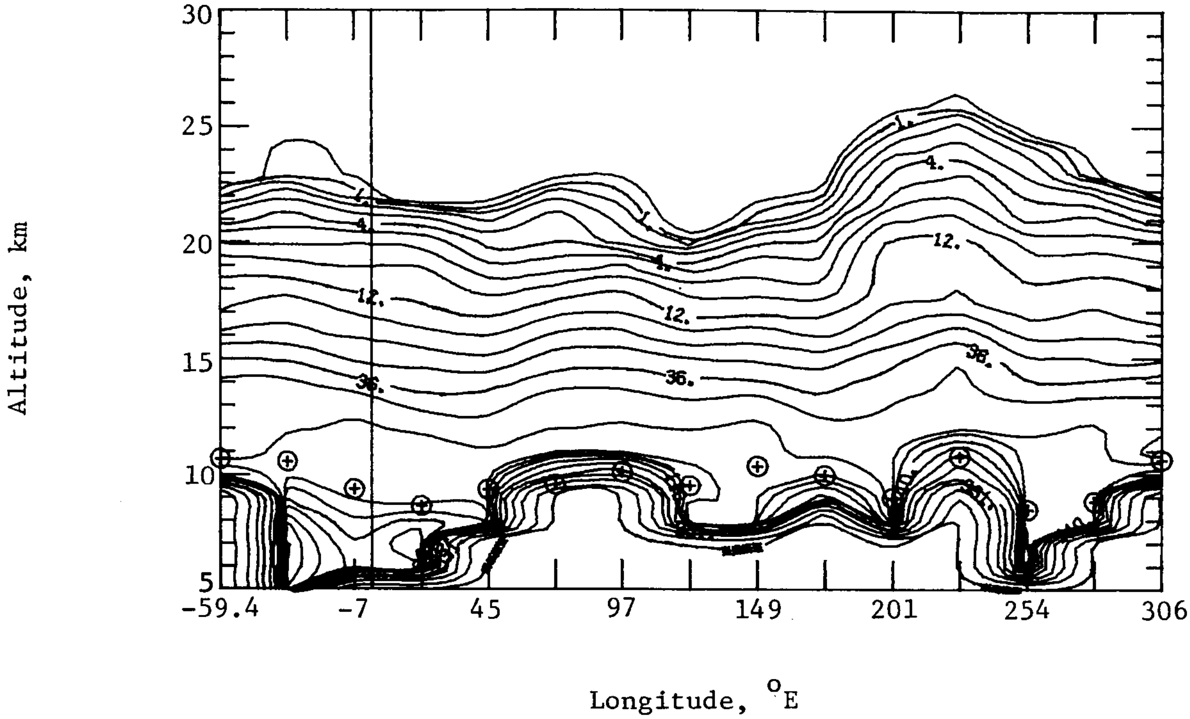


(a) Extinction isopleth.

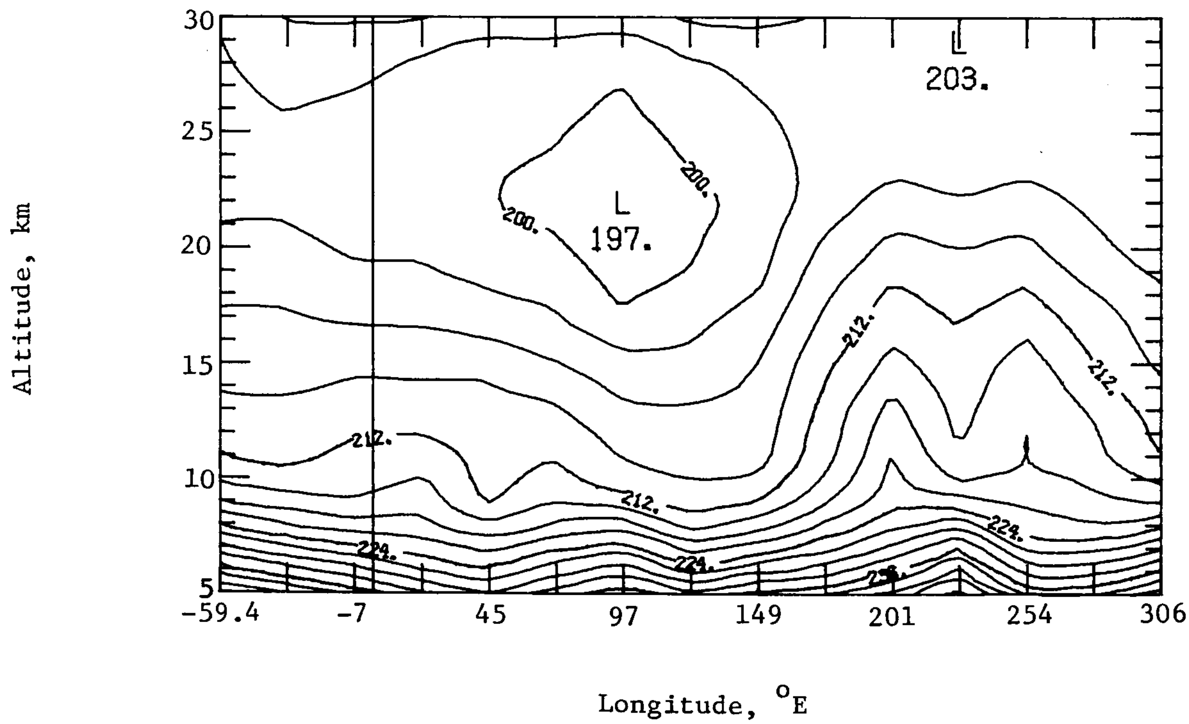


(b) Temperature contours.

Figure 40.- Antarctic extinction isopleth and temperature contours for May 13.74 to 14.75, 1982, at latitudes from 69.2° to 69.0° S corresponding to orbits 17 932 to 17 946.

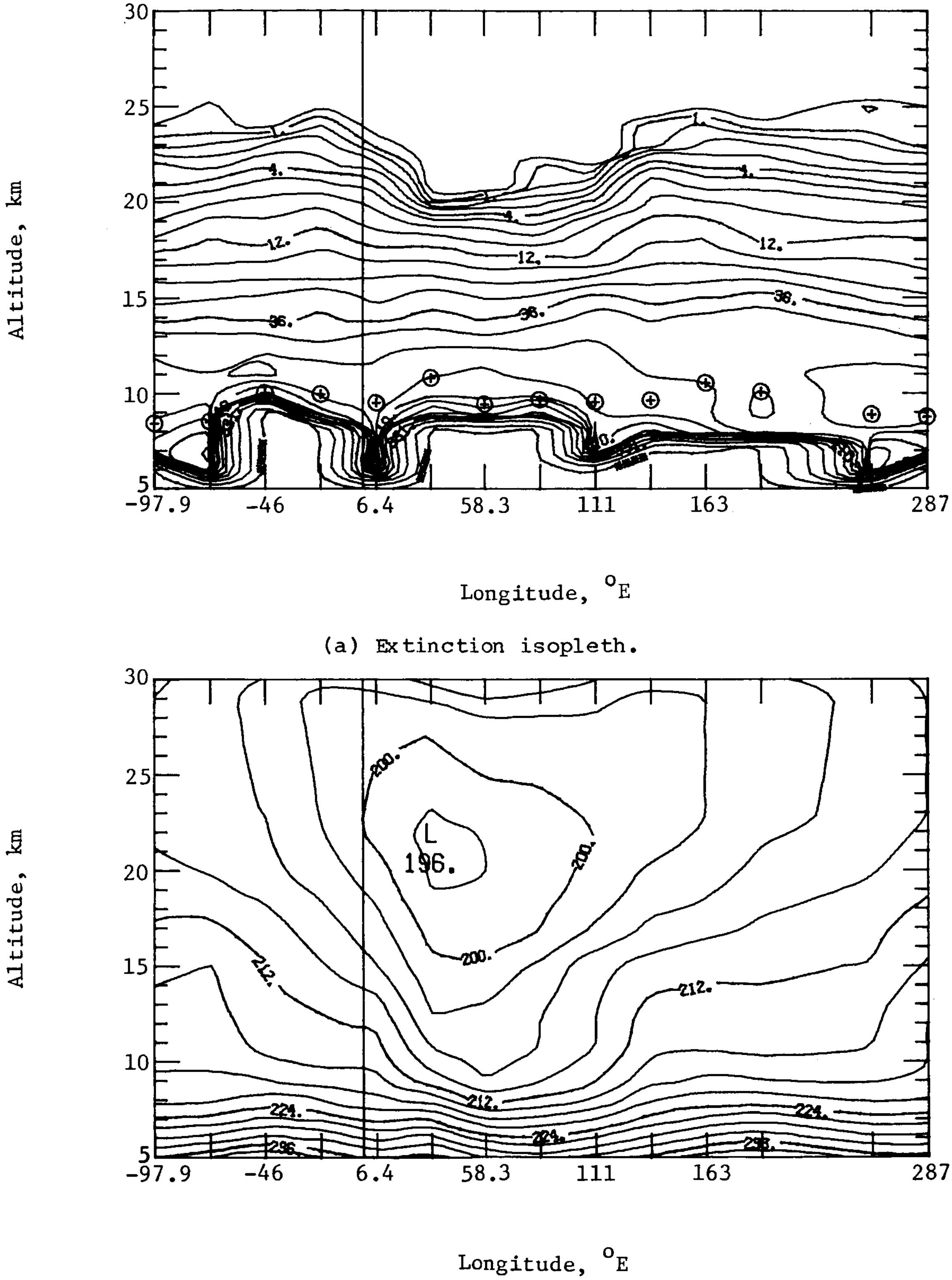


(a) Extinction isopleth.



(b) Temperature contours.

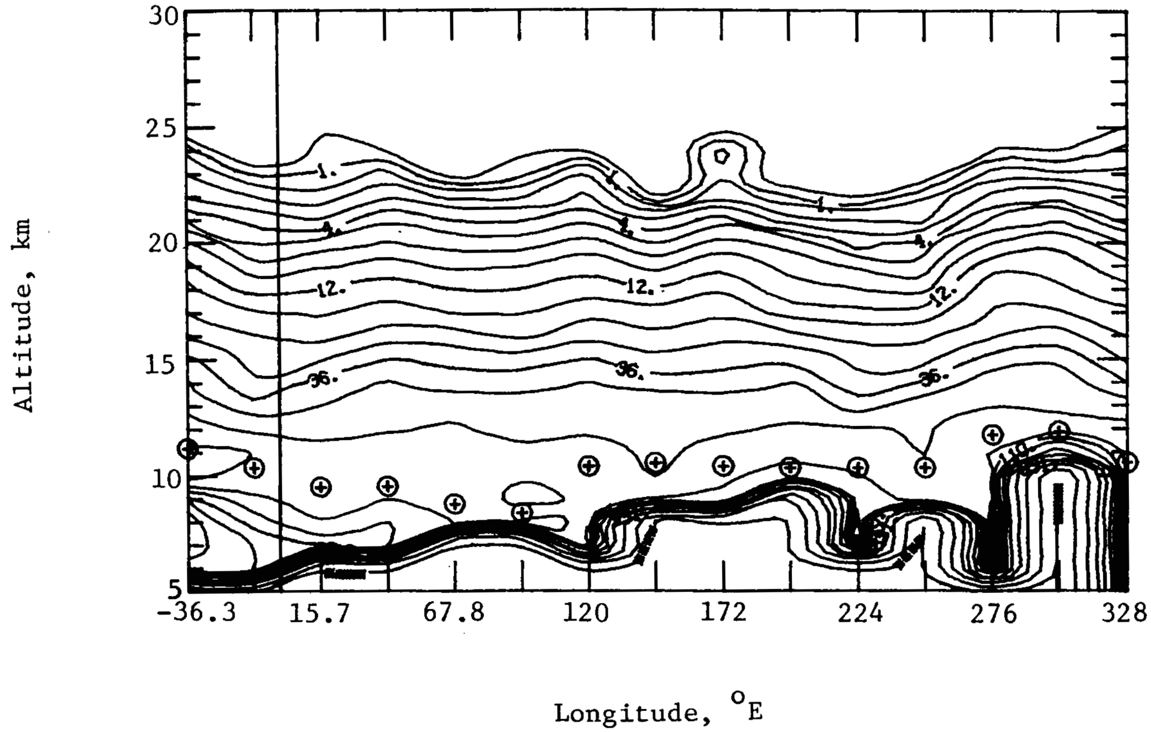
Figure 41.- Antarctic extinction isopleth and temperature contours for May 18.73 to 19.74, 1982, at latitudes from 68.2° to 68.0° S corresponding to orbits 18 001 to 18 015.



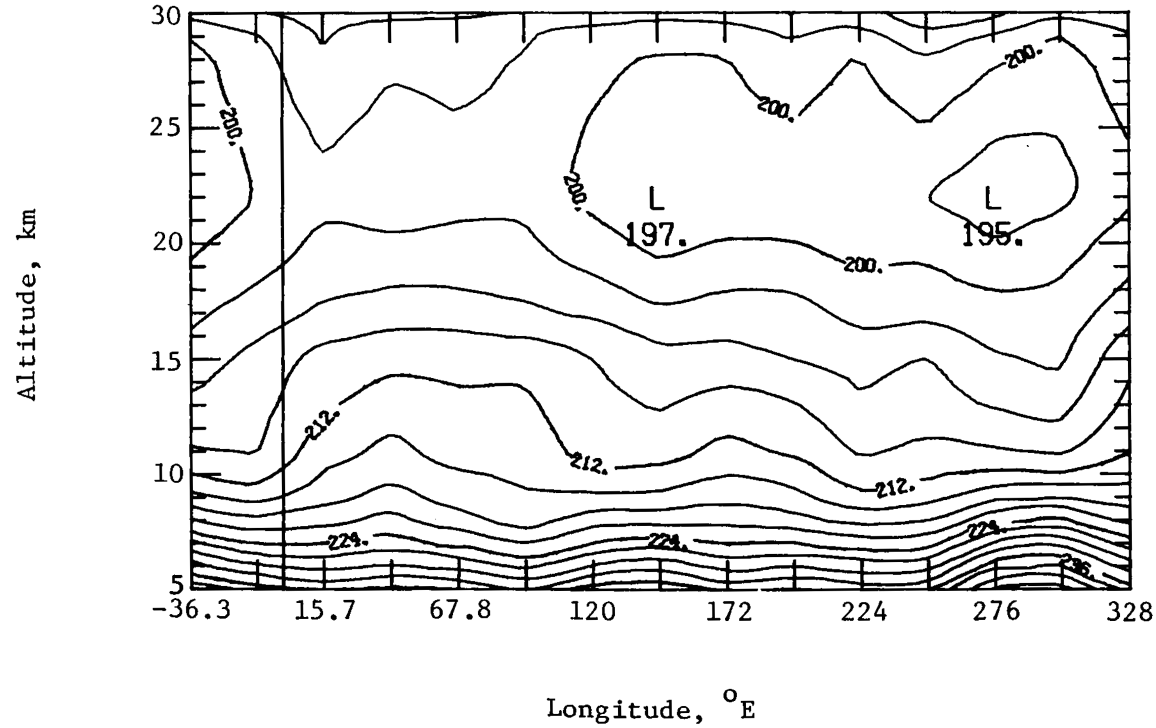
(a) Extinction isopleth.

(b) Temperature contours.

Figure 42.- Antarctic extinction isopleth and temperature contours for May 26.83 to 27.85, 1982, at latitudes from 66.8° to 66.6° S corresponding to orbits 18 113 to 18 127.

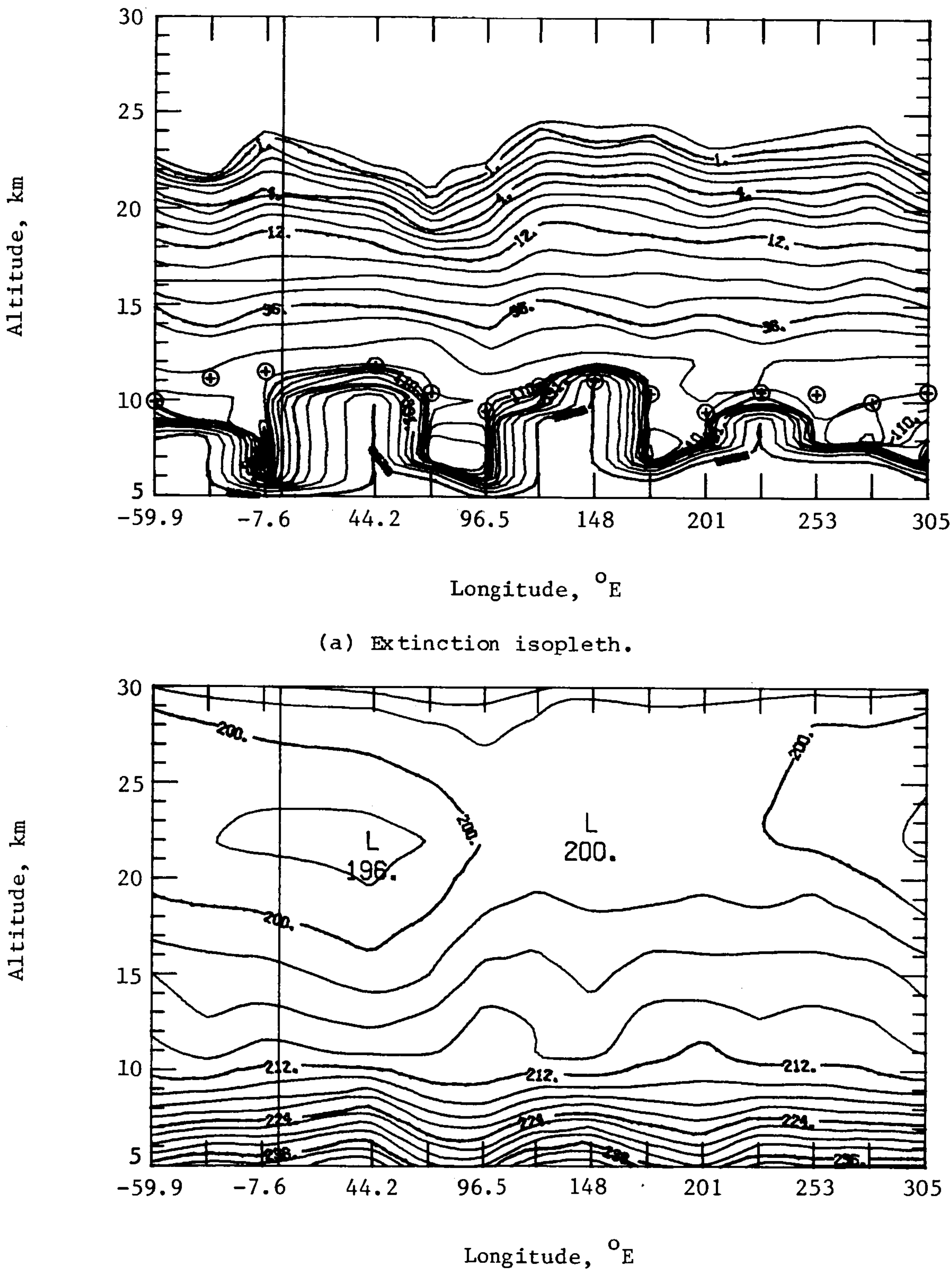


(a) Extinction isopleth.



(b) Temperature contours.

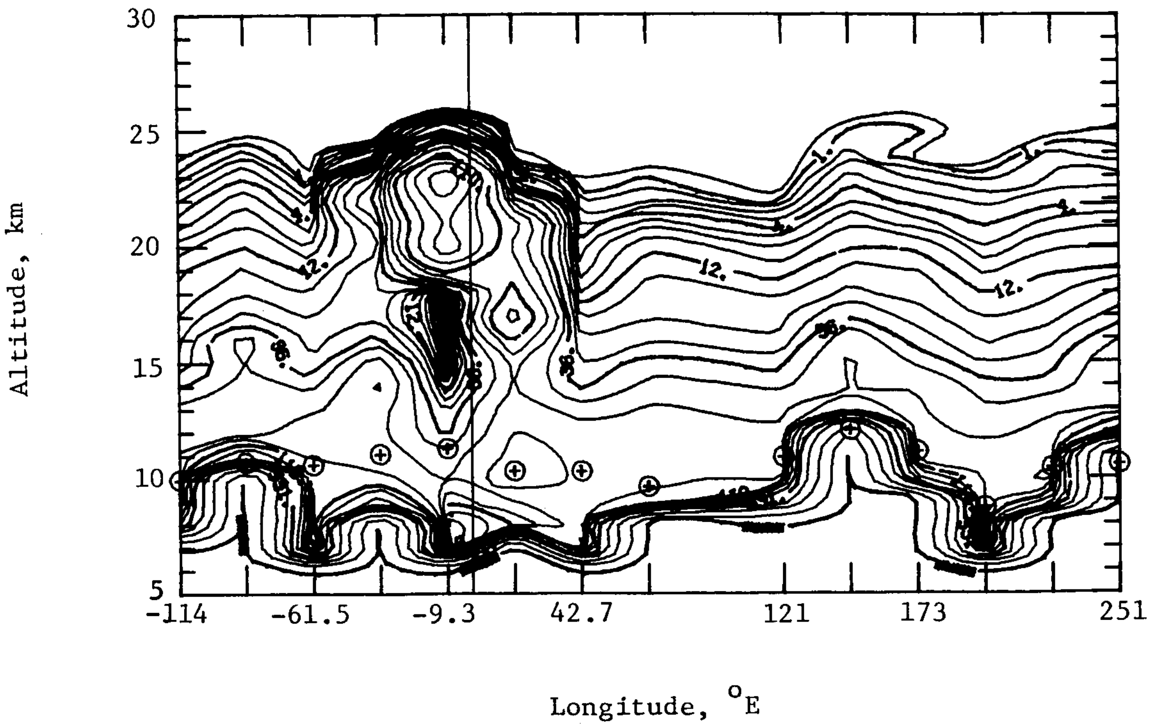
Figure 43.- Antarctic extinction isopleth and temperature contours for June 4.66 to 5.67, 1982, at latitudes from 65.6° to 65.5° S corresponding to orbits 18 235 to 18 249.



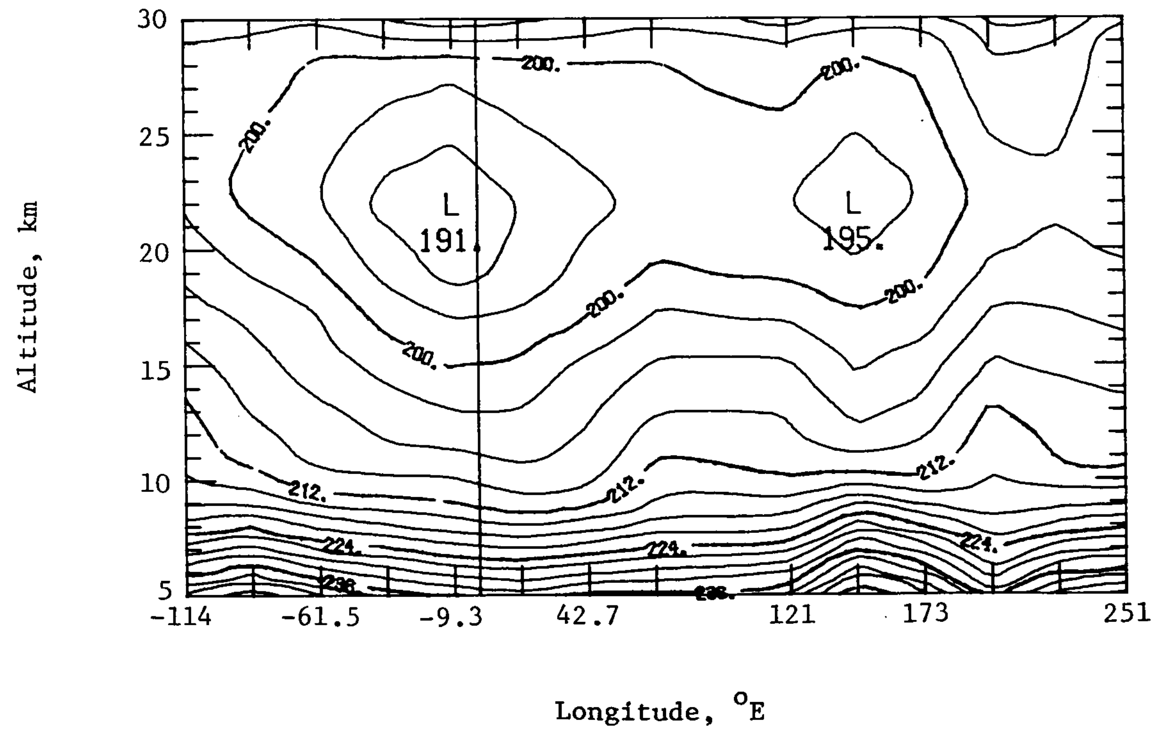
(a) Extinction isopleth.

(b) Temperature contours.

Figure 44.- Antarctic extinction isopleth and temperature contours for June 9.72 to 10.74, 1982, at latitudes from 65.2° to 65.1° S corresponding to orbits 18 305 to 18 319.

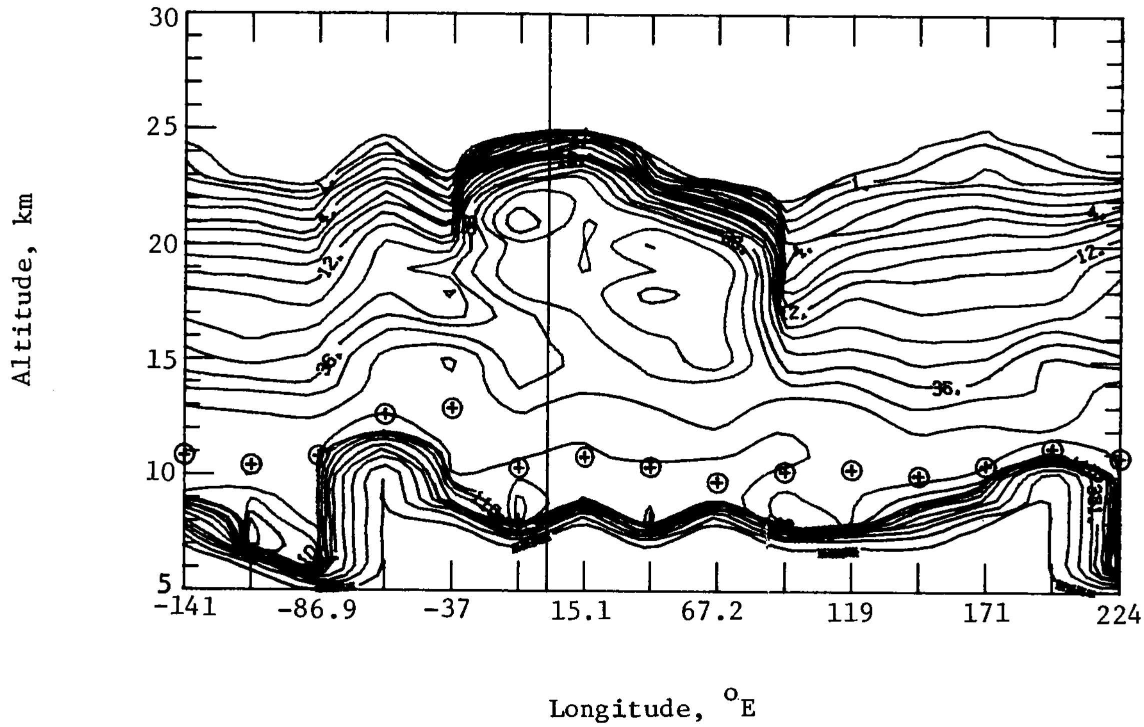


(a) Extinction isopleth.

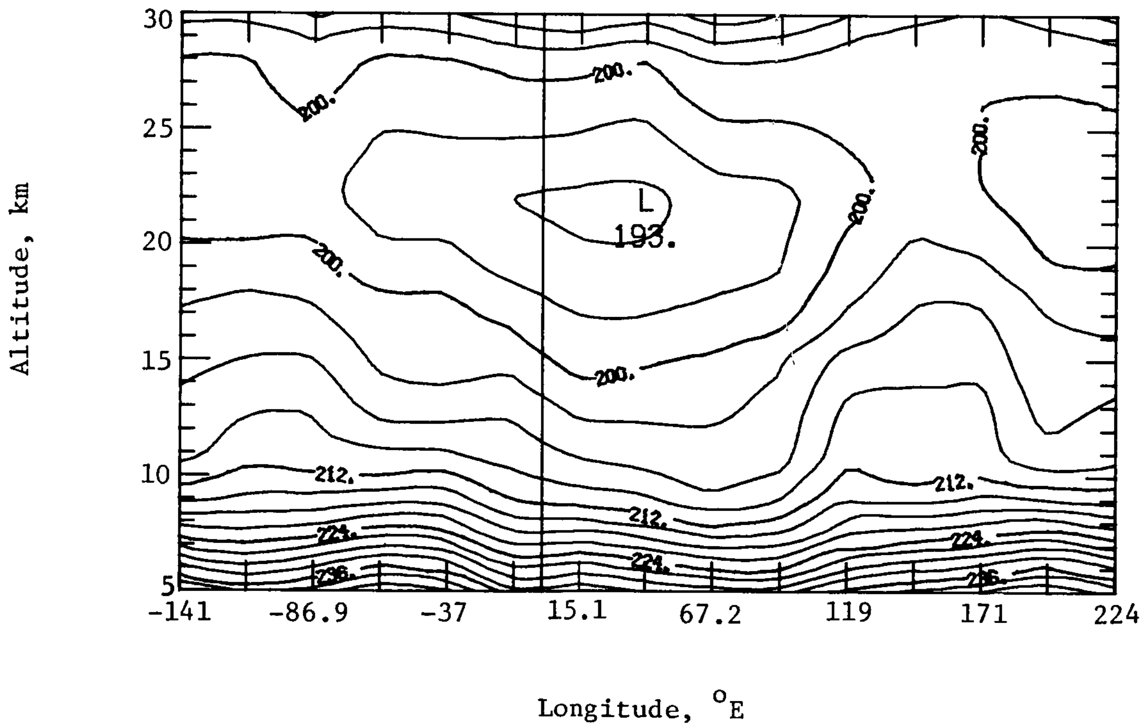


(b) Temperature contours.

Figure 45.- Antarctic extinction isopleth and temperature contours for June 15.87 to 16.89, 1982, at latitudes from 64.9° to 64.8° S corresponding to orbits 18 390 to 18 404.

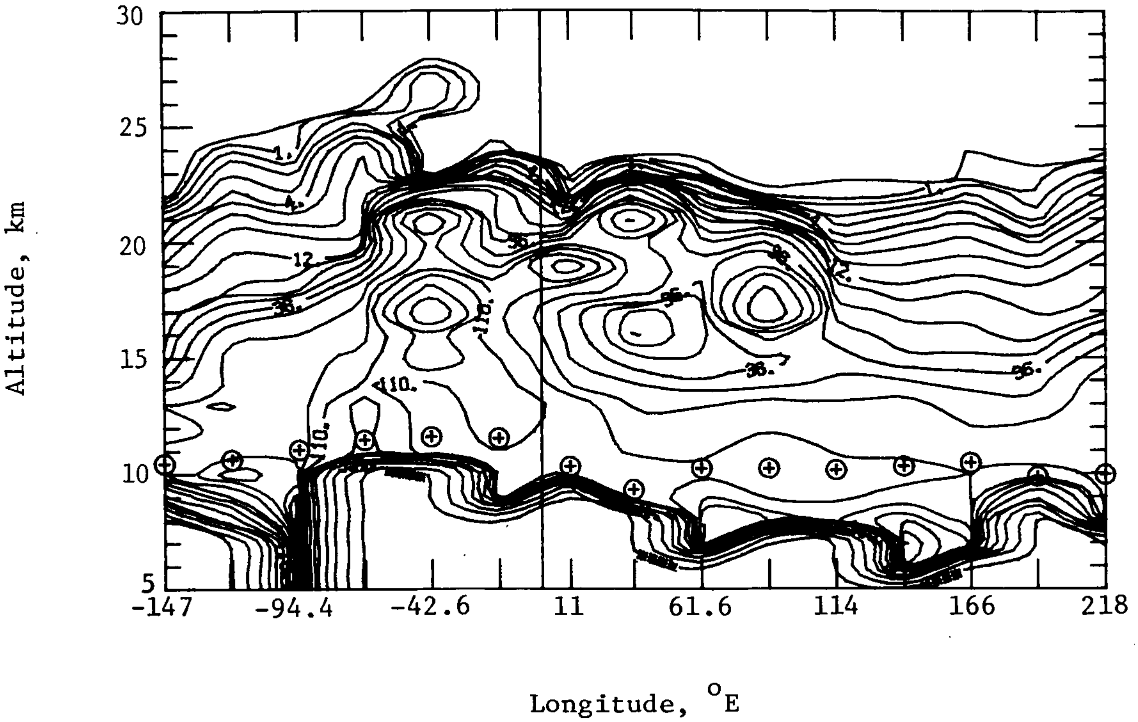


(a) Extinction isopleth.

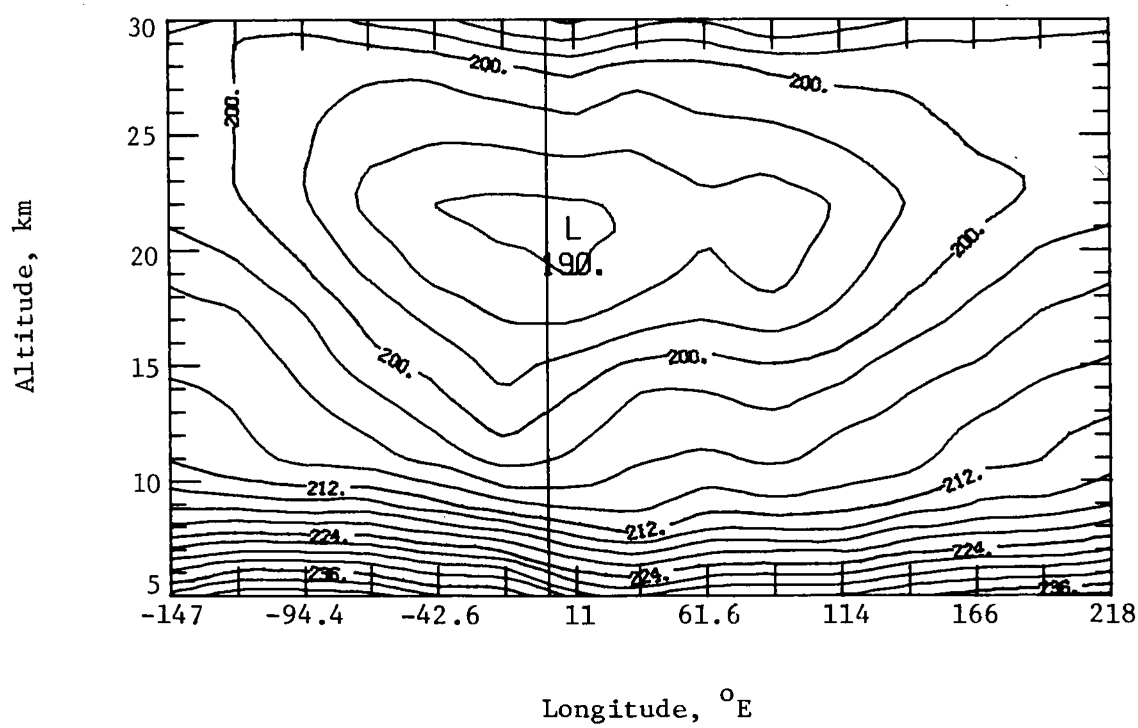


(b) Temperature contours.

Figure 46.- Antarctic extinction isopleth and temperature contours for June 21.95 to 22.96, 1982, at latitudes from 64.7° to 64.8° S corresponding to orbits 18 474 to 18 488.

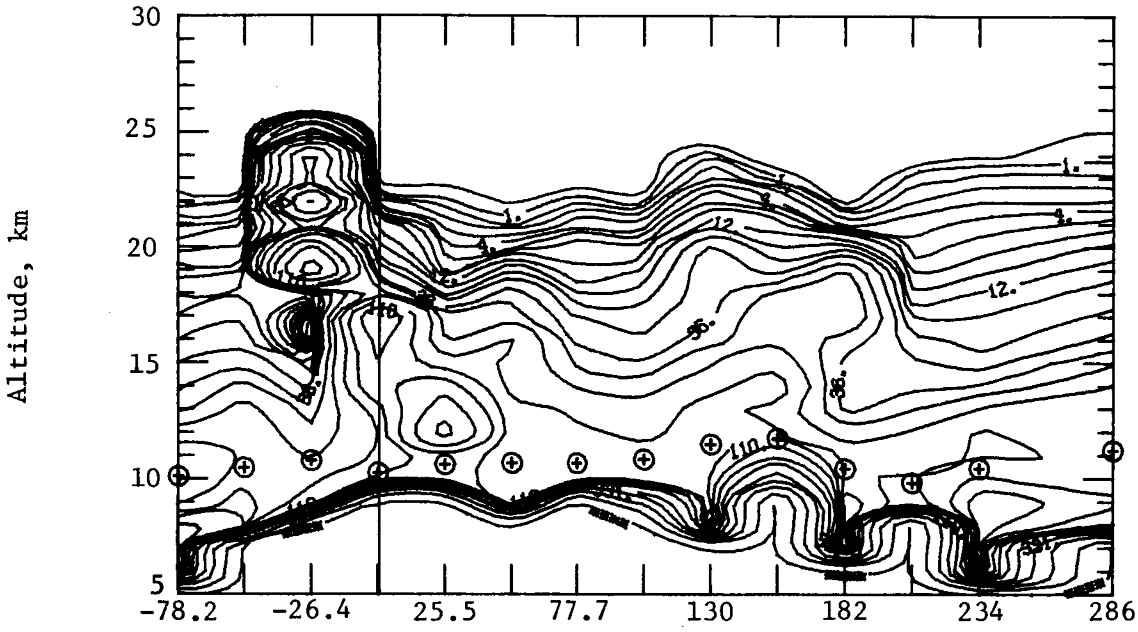


(a) Extinction isopleth.

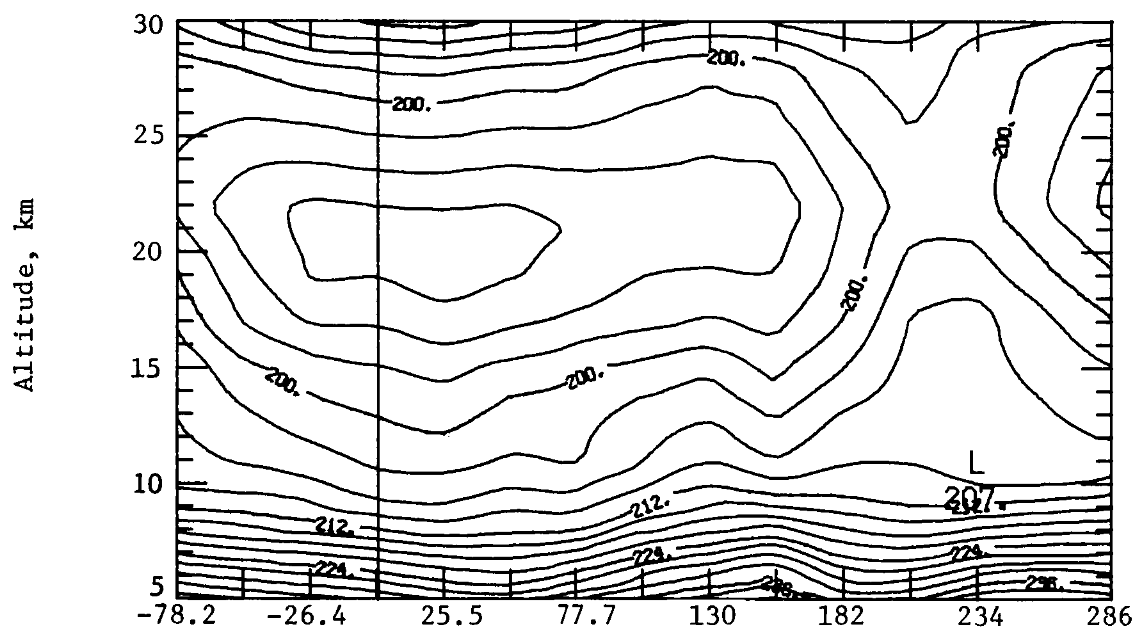


(b) Temperature contours.

Figure 47.- Antarctic extinction isopleth and temperature contours for June 28.97 to 29.98, 1982, at a latitude of 64.9° S corresponding to orbits 18 571 to 18 585.

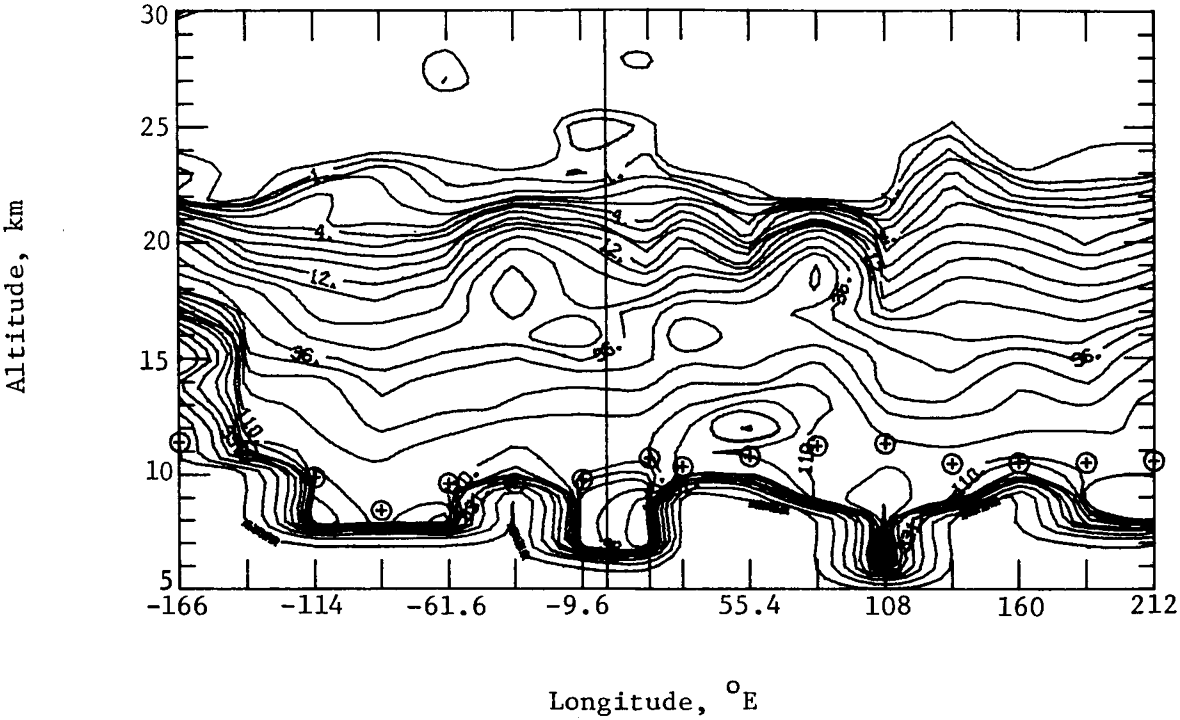


(a) Extinction isopleth.

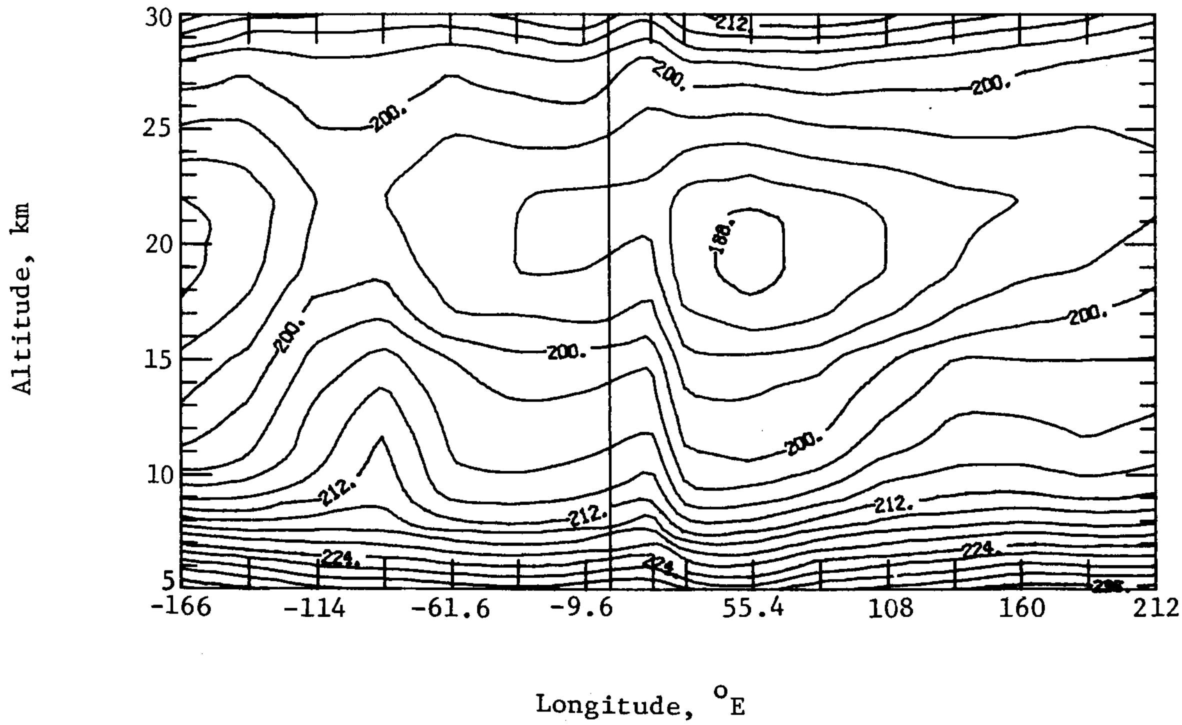


(b) Temperature contours.

Figure 48.- Antarctic extinction isopleth and temperature contours for July 6.78 to 7.80, 1982, at a latitude of 65.4° S corresponding to orbits 18 679 to 18 693.

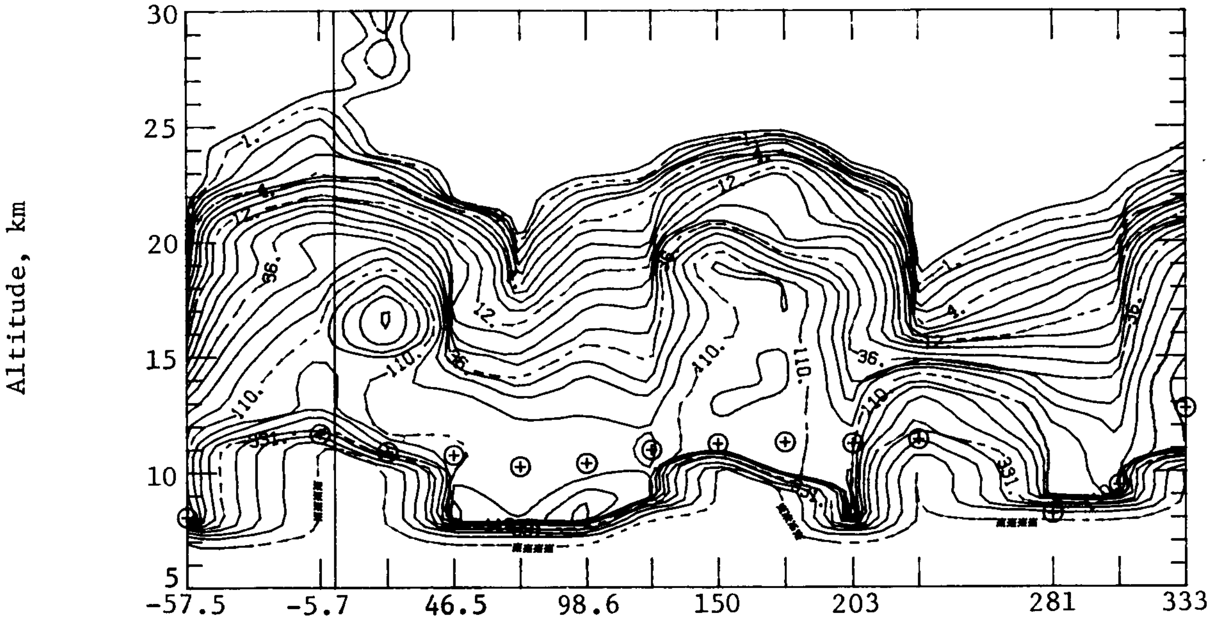


(a) Extinction isopleth.

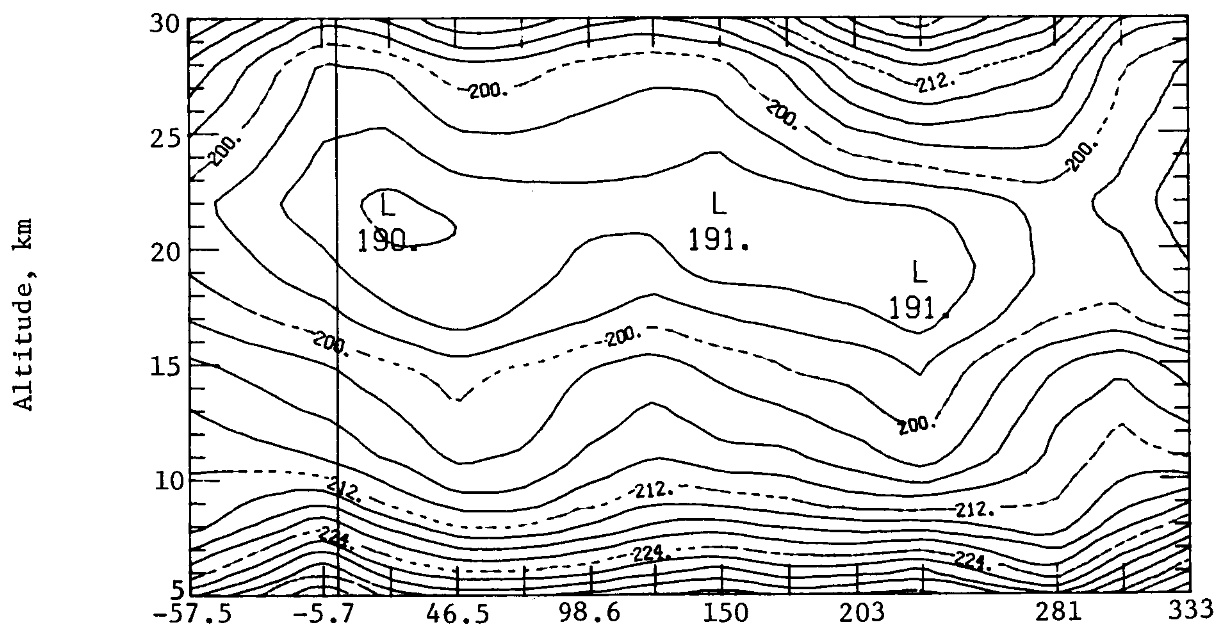


(b) Temperature contours.

Figure 49.- Antarctic extinction isopleth and temperature contours for July 11.05 to 11.99, 1982, at latitudes from 65.8° to 65.9° S corresponding to orbits 18 738 to 18 751.

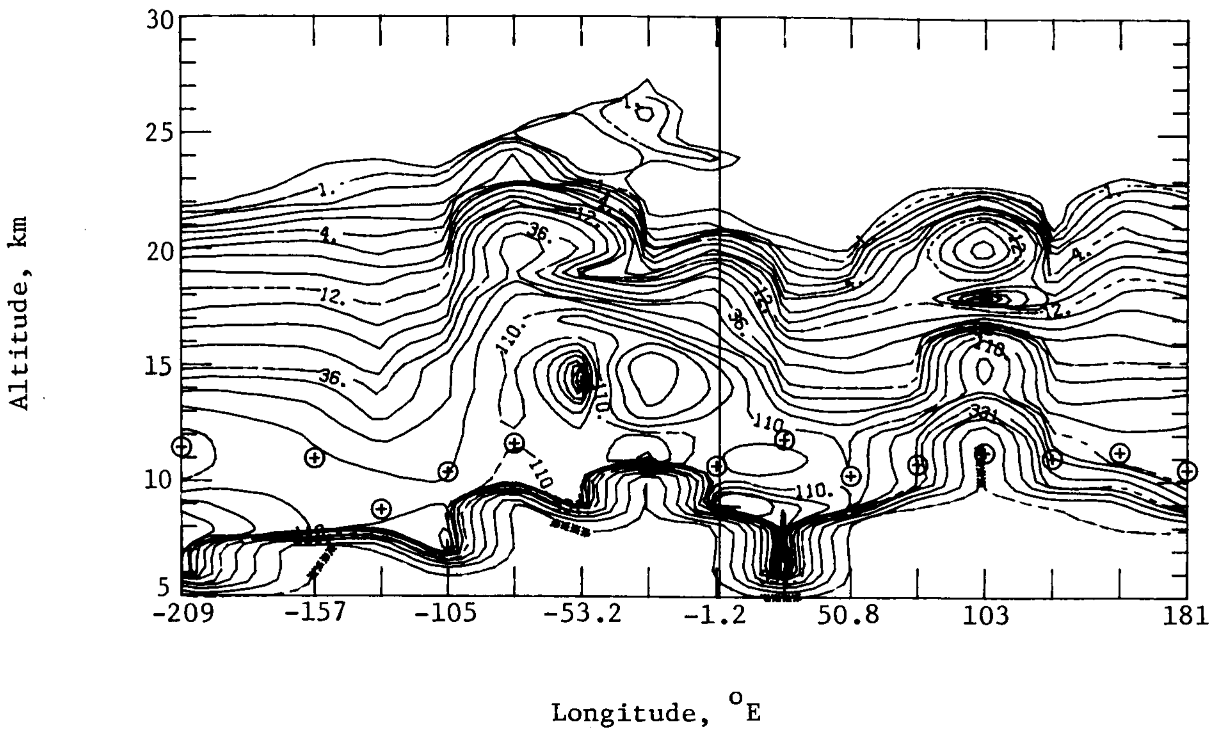


(a) Extinction isopleth.

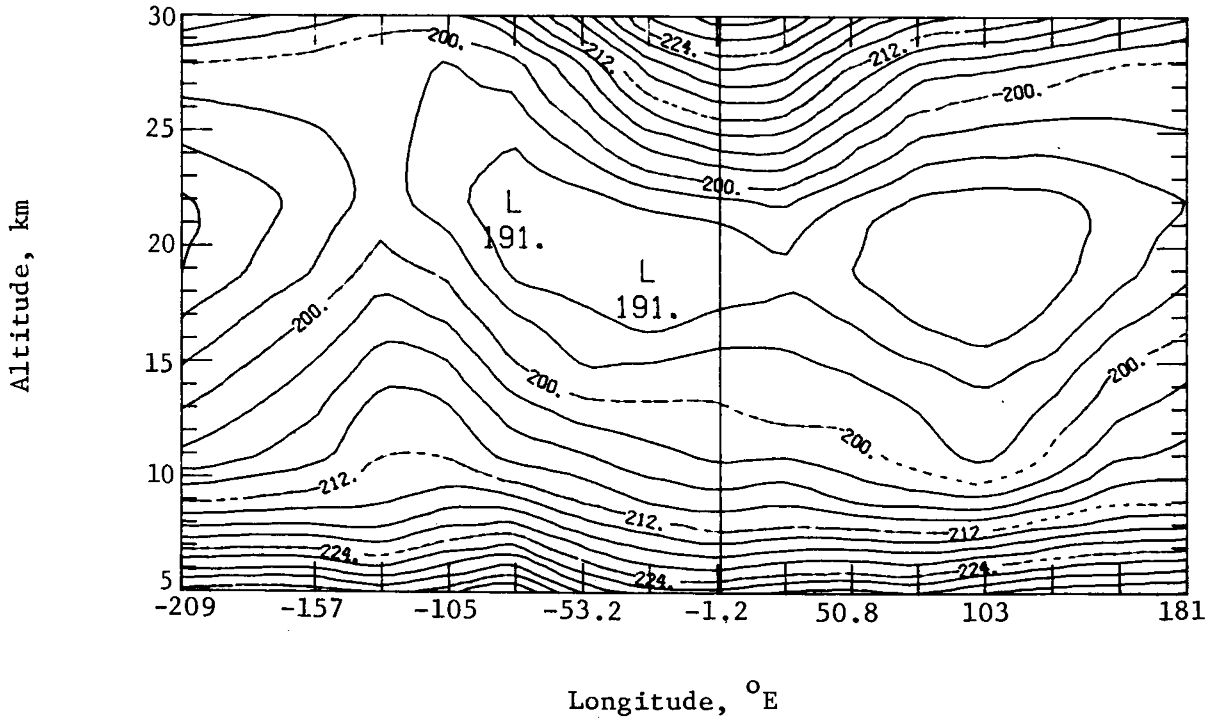


(b) Temperature contours.

Figure 50.- Antarctic extinction isopleth and temperature contours for July 19.66 to 20.75, 1982, at latitudes from 67.0° to 67.1° S corresponding to orbits 18 857 to 18 872.

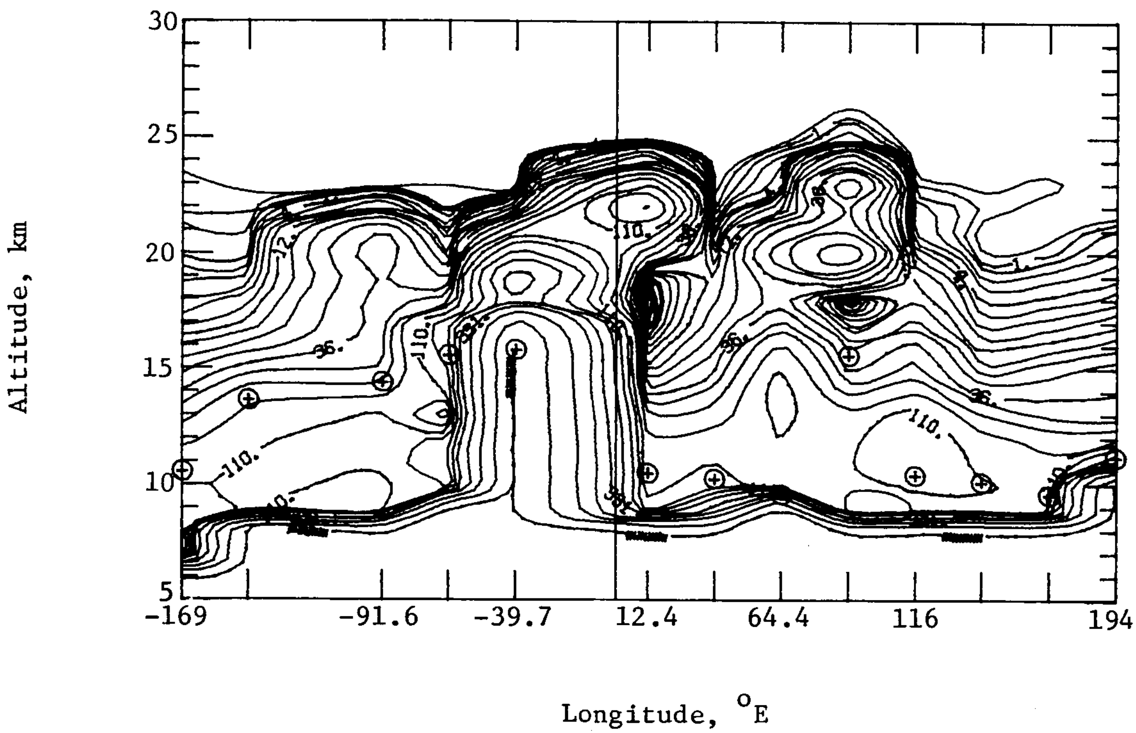


(a) Extinction isopleth.

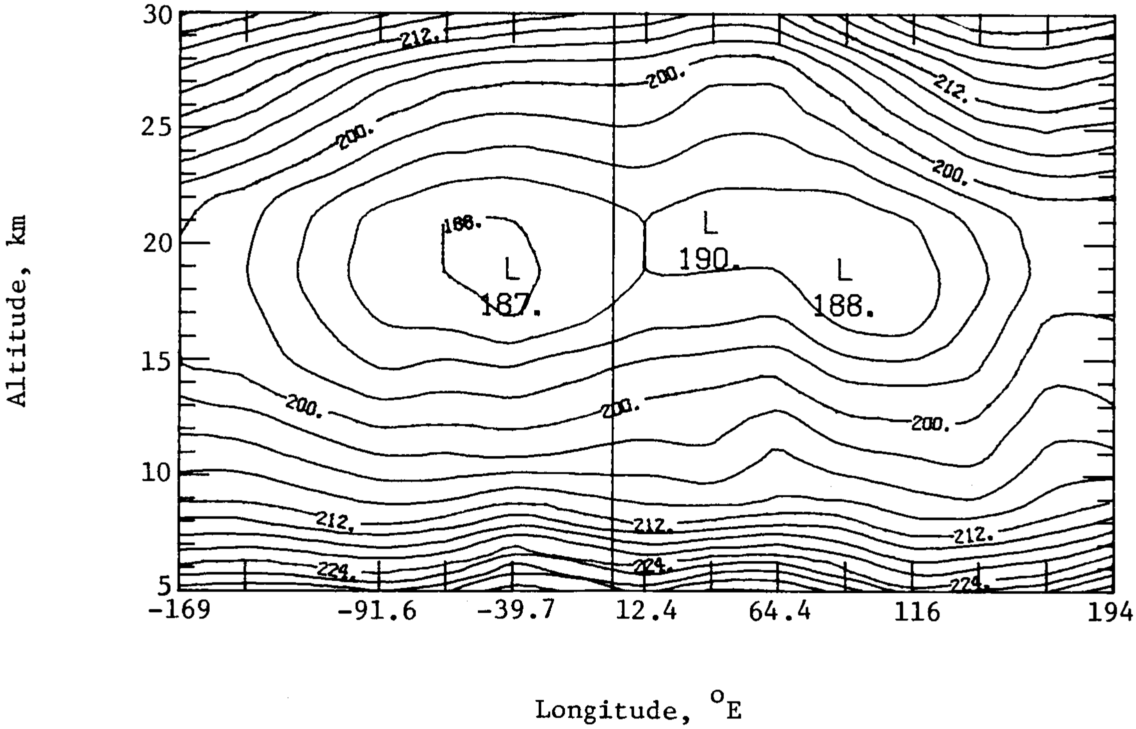


(b) Temperature contours.

Figure 51.- Antarctic extinction isopleth and temperature contours for July 25.09 to 26.17, 1982, at latitudes from 67.9° to 68.0° S corresponding to orbits 18 932 to 18 947.

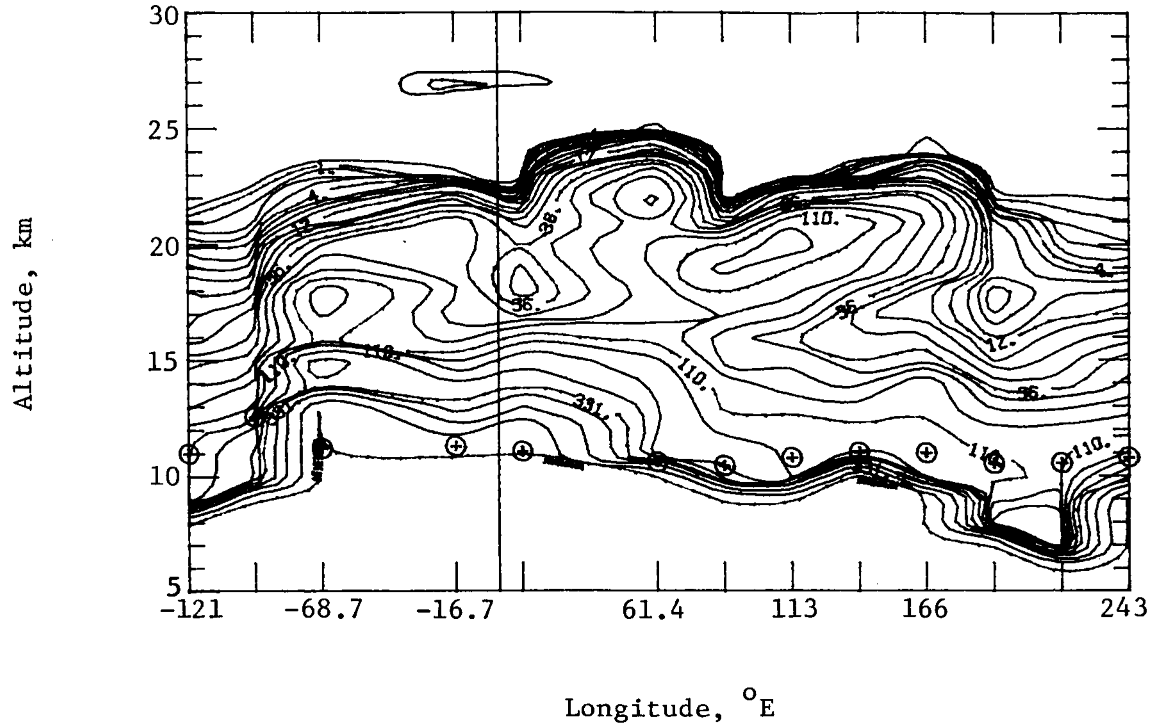


(a) Extinction isopleth.

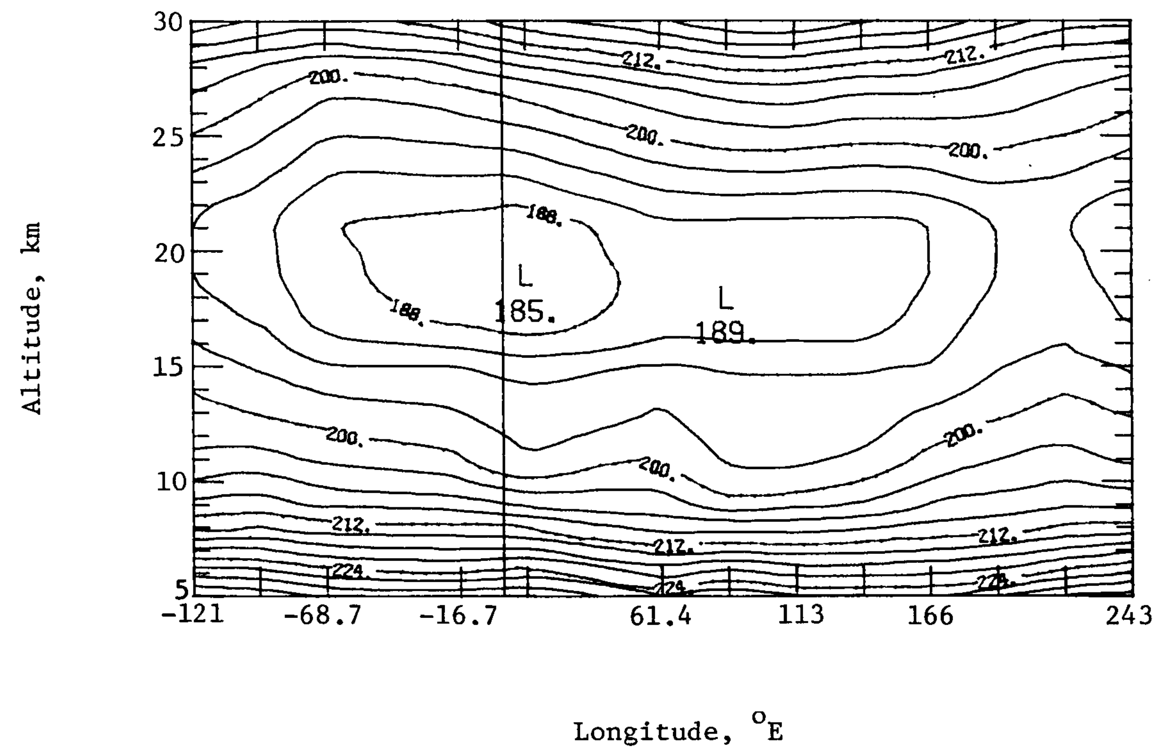


(b) Temperature contours.

Figure 52.- Antarctic extinction isopleth and temperature contours for August 3.06 to 4.07, 1982, at latitudes from 69.6° to 69.8° S corresponding to orbits 19 056 to 19 070.

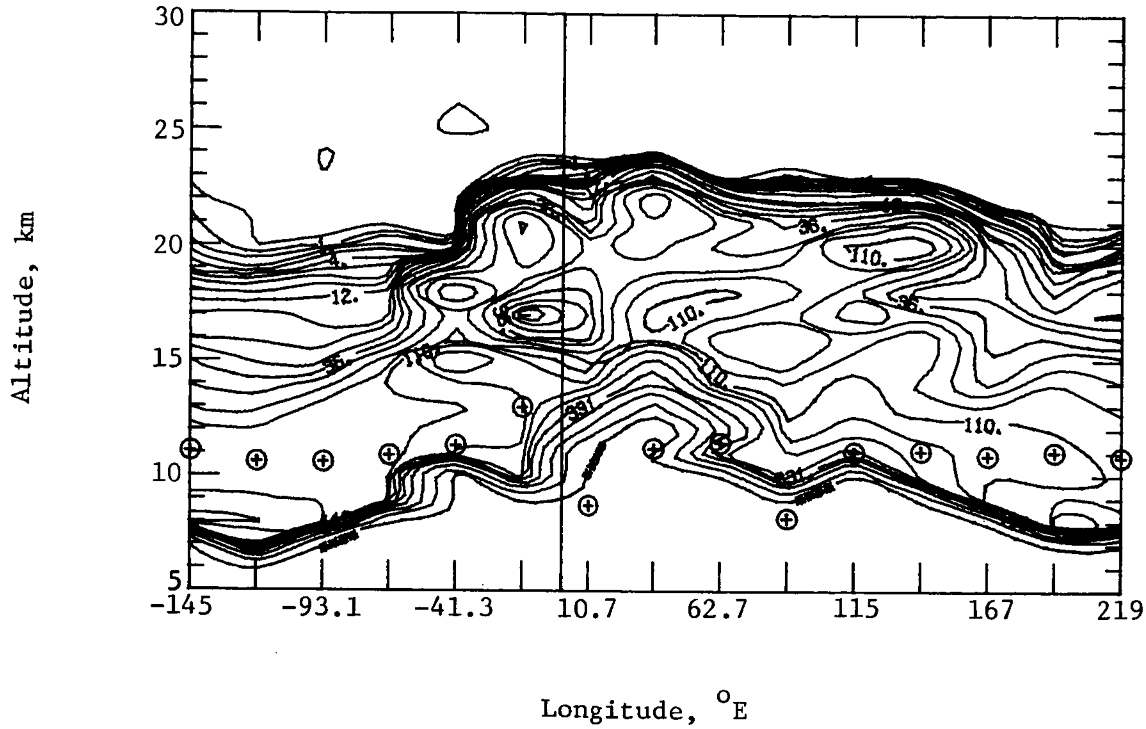


(a) Extinction isopleth.

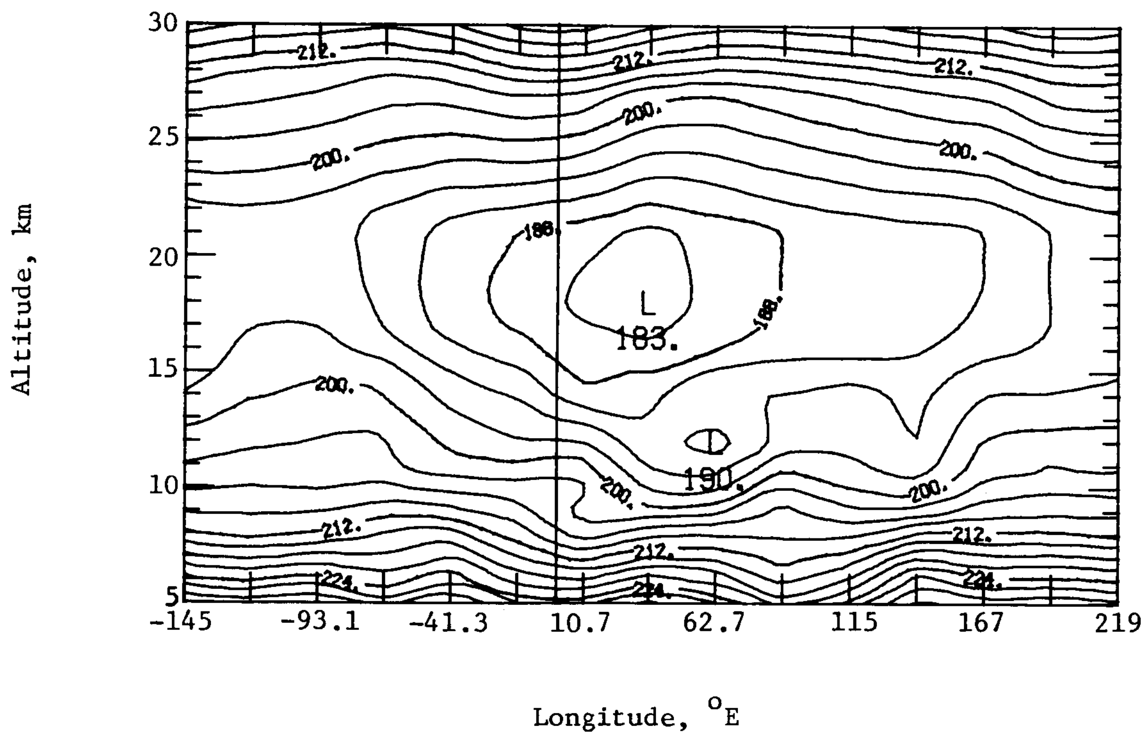


(b) Temperature contours.

Figure 53.- Antarctic extinction isopleth and temperature contours for August 9.93 to 10.94, 1982, at latitudes from 71.1° to 71.4° S corresponding to orbits 19 151 to 19 165.

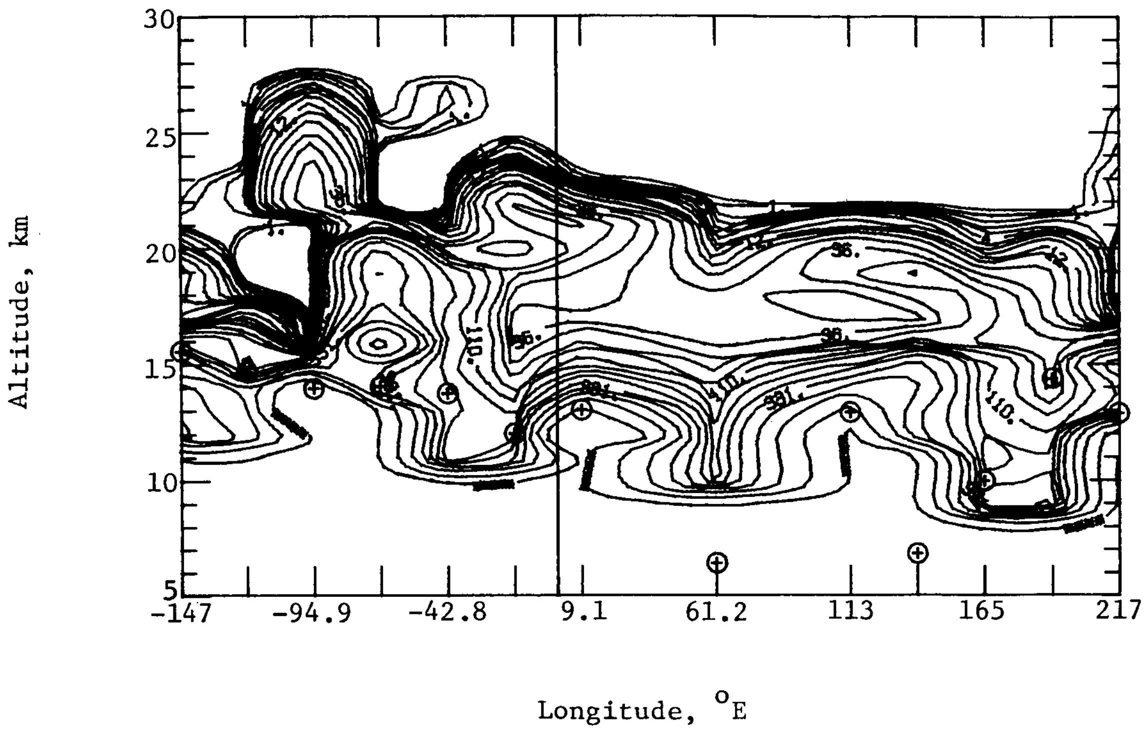


(a) Extinction isopleth.

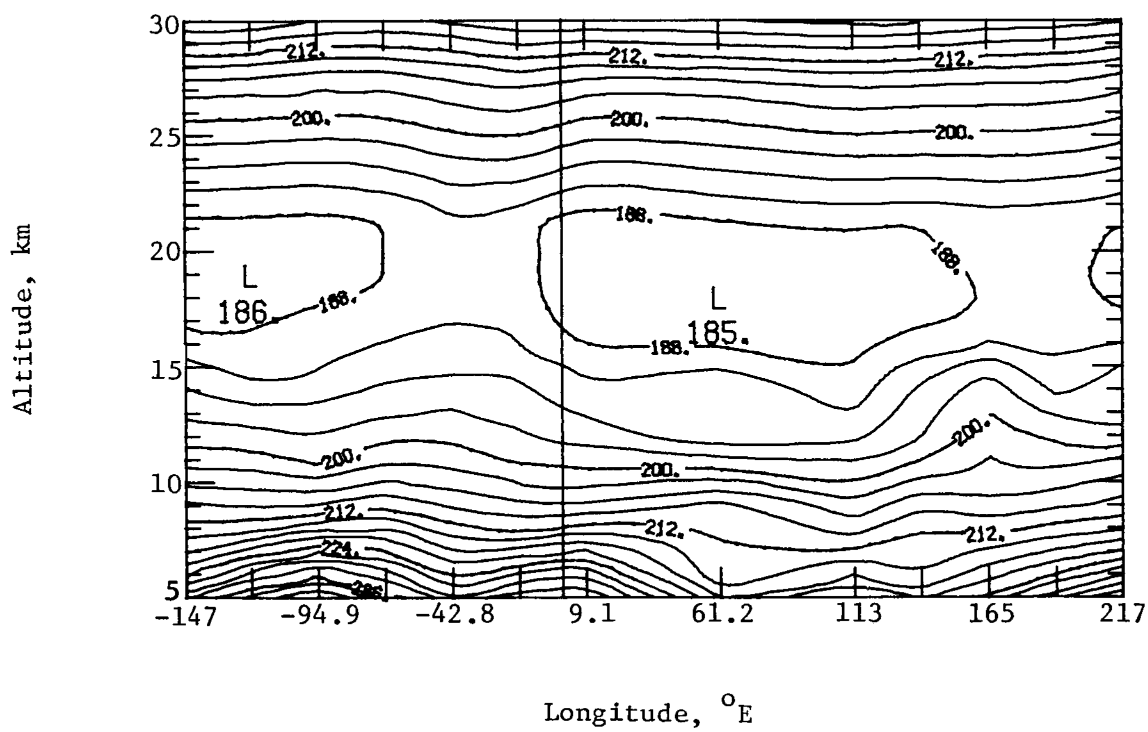


(b) Temperature contours.

Figure 54.- Antarctic extinction isopleth and temperature contours for August 16.01 to 17.02, 1982, at latitudes from 72.6° to 72.8° S corresponding to orbits 19 235 to 19 249.

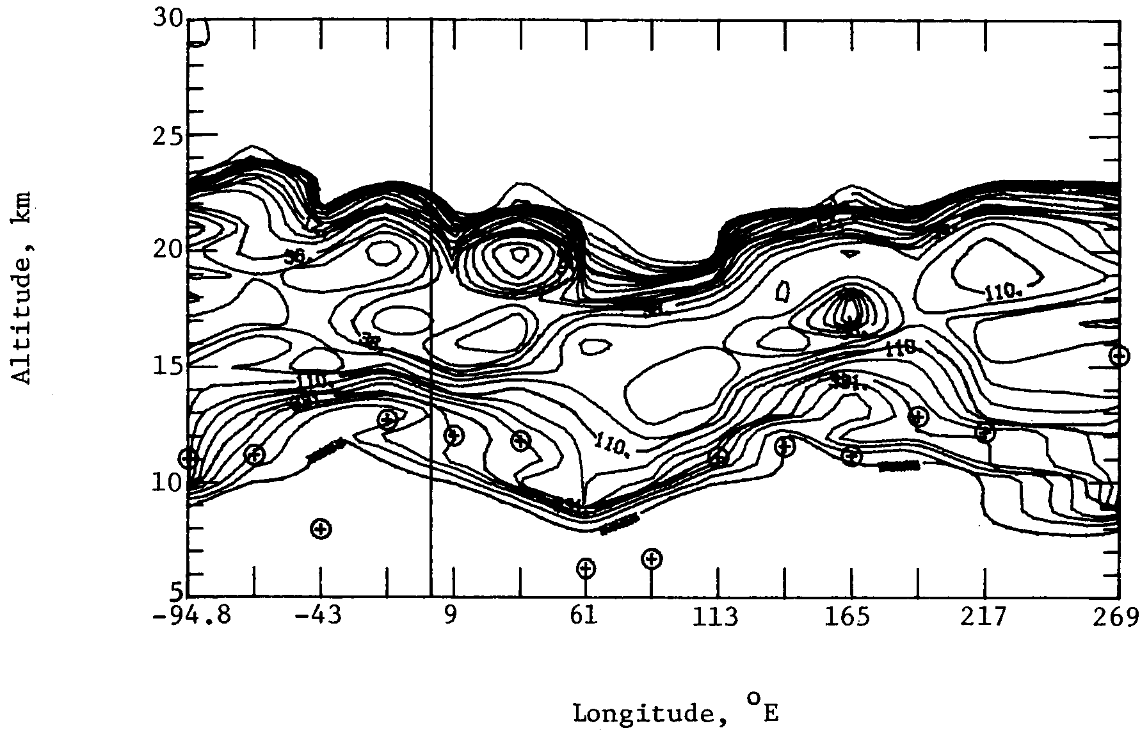


(a) Extinction isopleth.

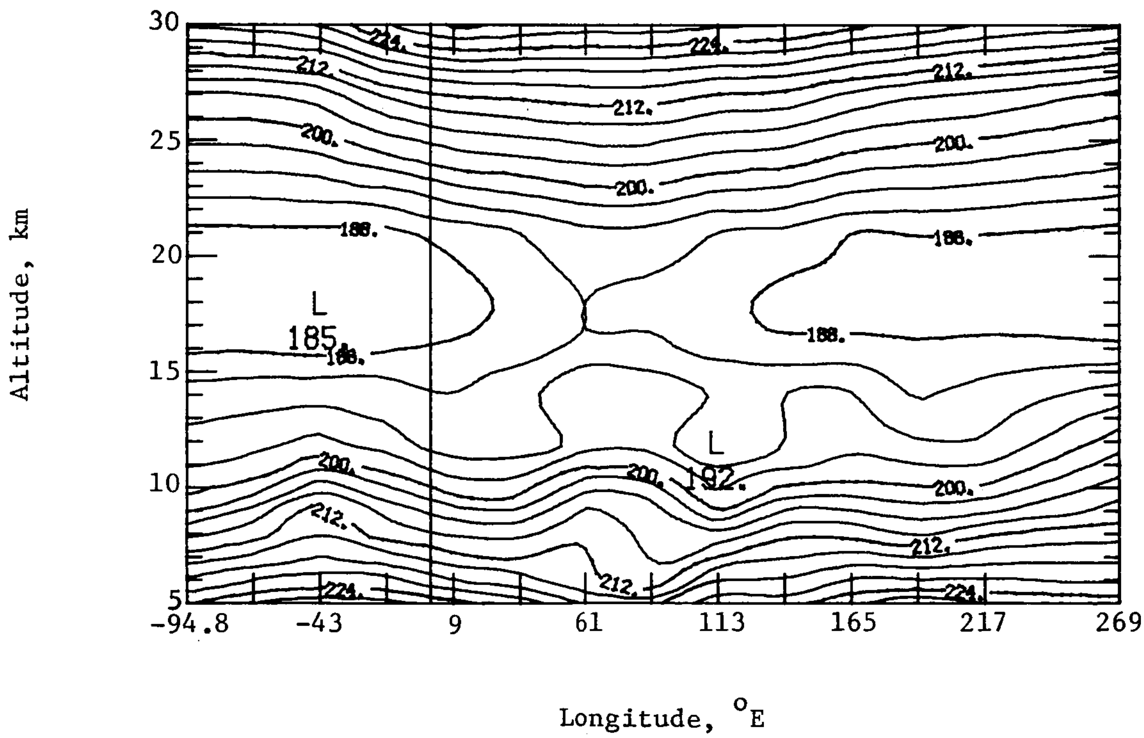


(b) Temperature contours.

Figure 55.- Antarctic extinction isopleth and temperature contours for August 23.02 to 24.04, 1982, at latitudes from 74.4° to 74.6° S corresponding to orbits 19 332 to 19 346.

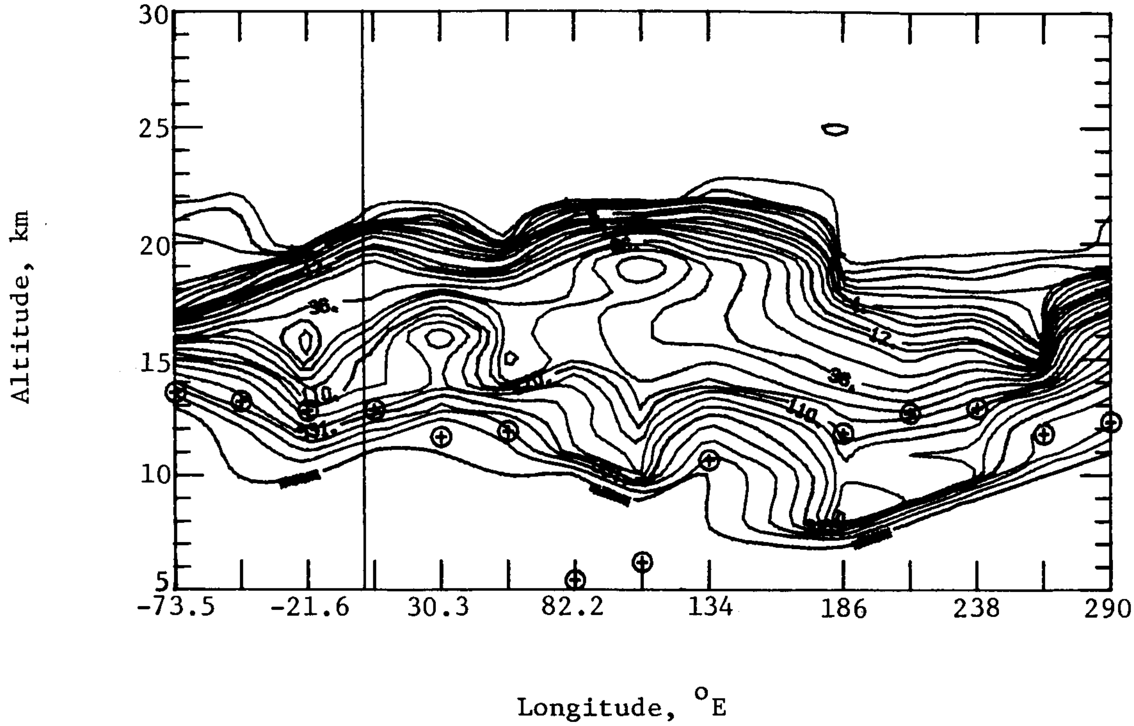


(a) Extinction isopleth.

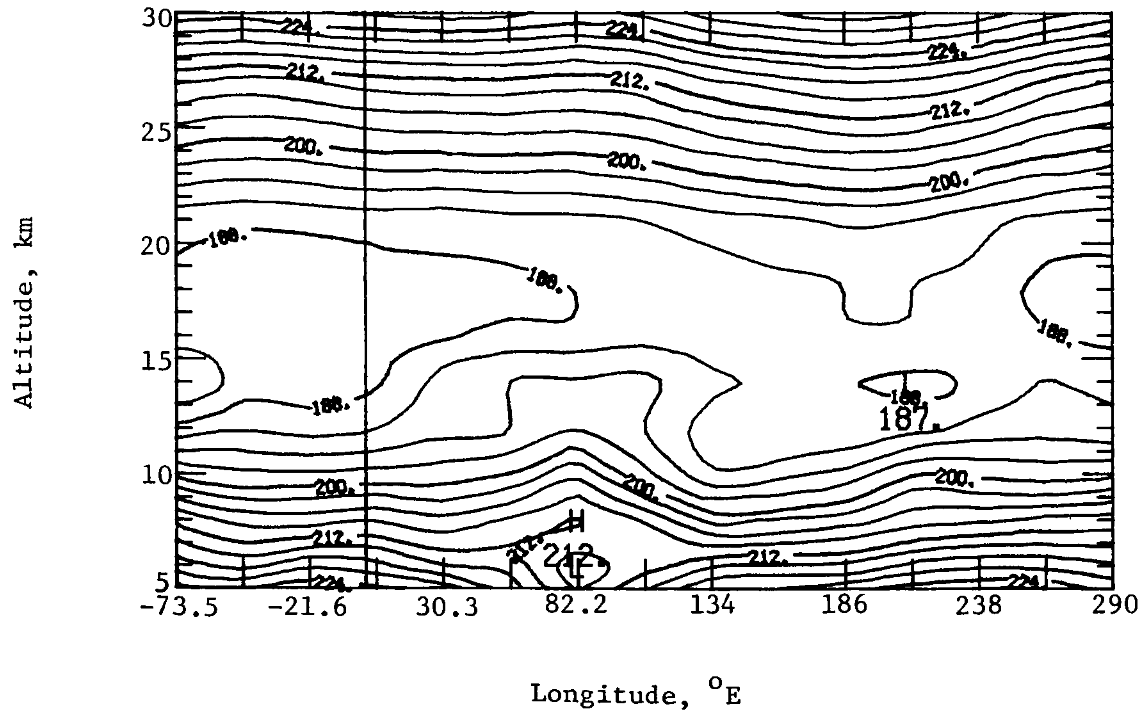


(b) Temperature contours.

Figure 56.- Antarctic extinction isopleth and temperature contours for August 29.90 to 30.91, 1982, at latitudes from 76.0° to 76.3° S corresponding to orbits 19 427 to 19 441.

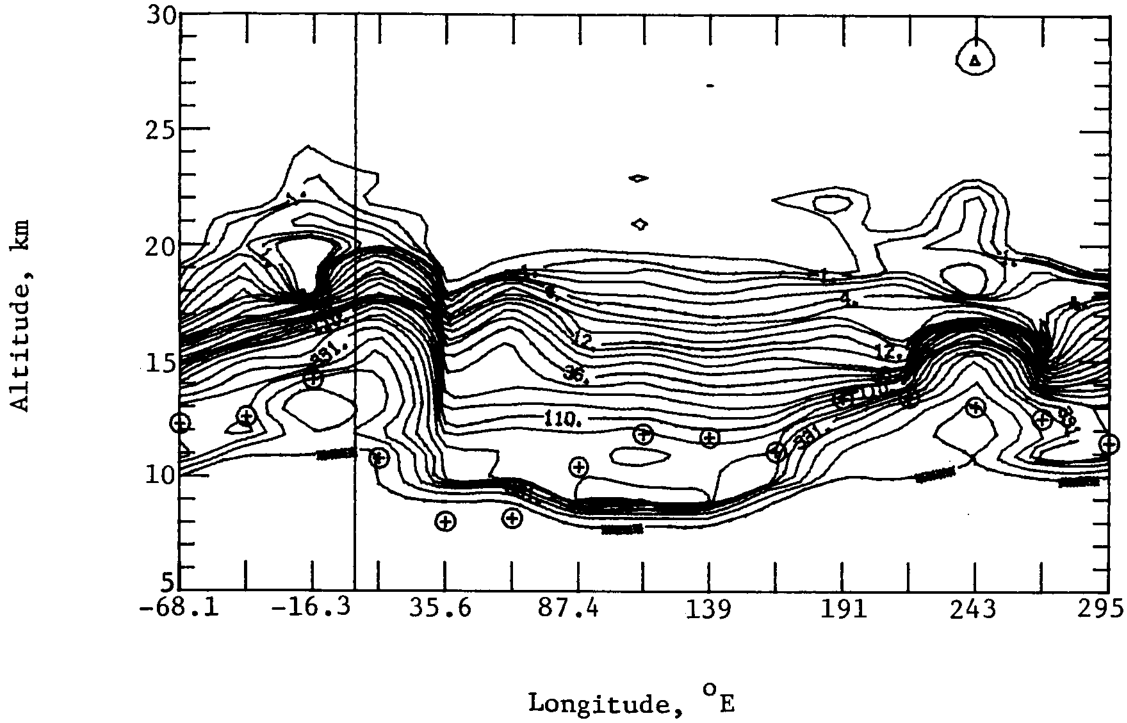


(a) Extinction isopleth.

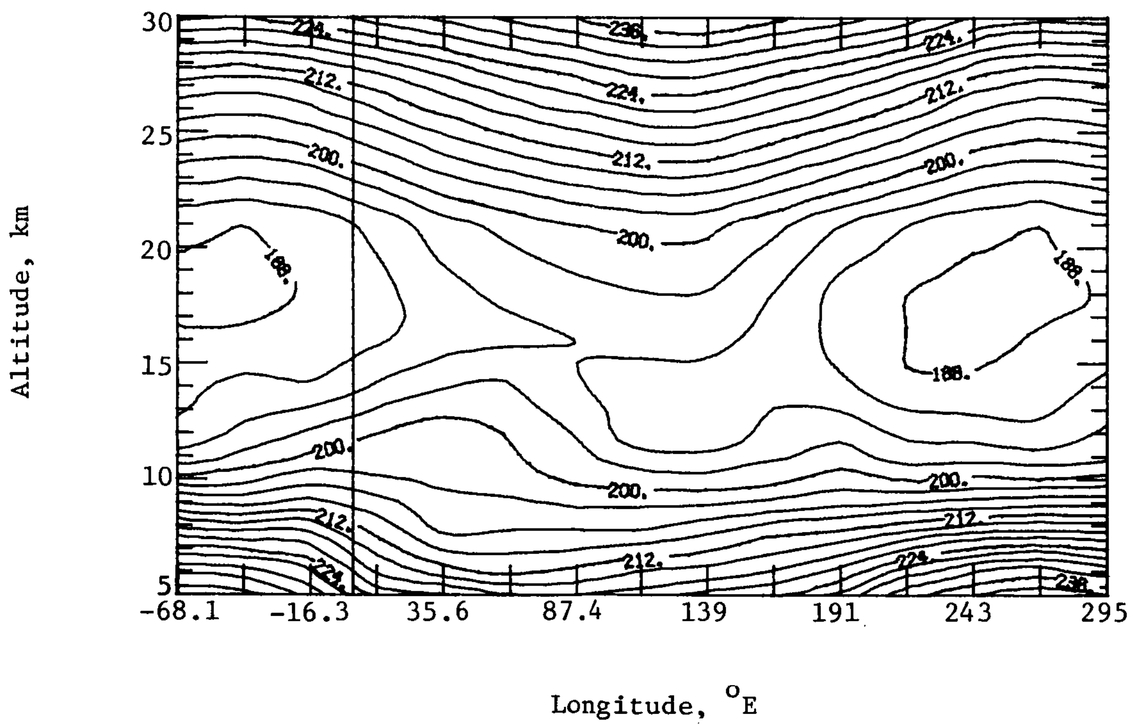


(b) Temperature contours.

Figure 57.- Antarctic extinction isopleth and temperature contours for September 7.87 to 8.88, 1982, at latitudes from 78.2° to 78.4° S corresponding to orbits 19 551 to 19 565.

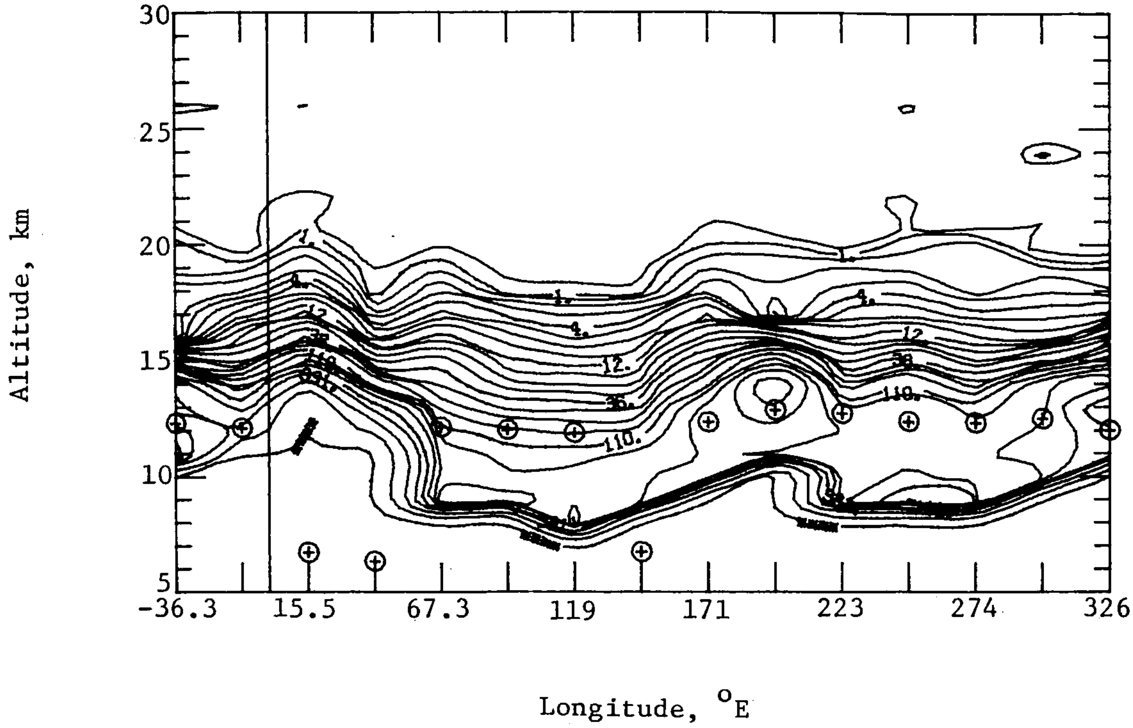


(a) Extinction isopleth.

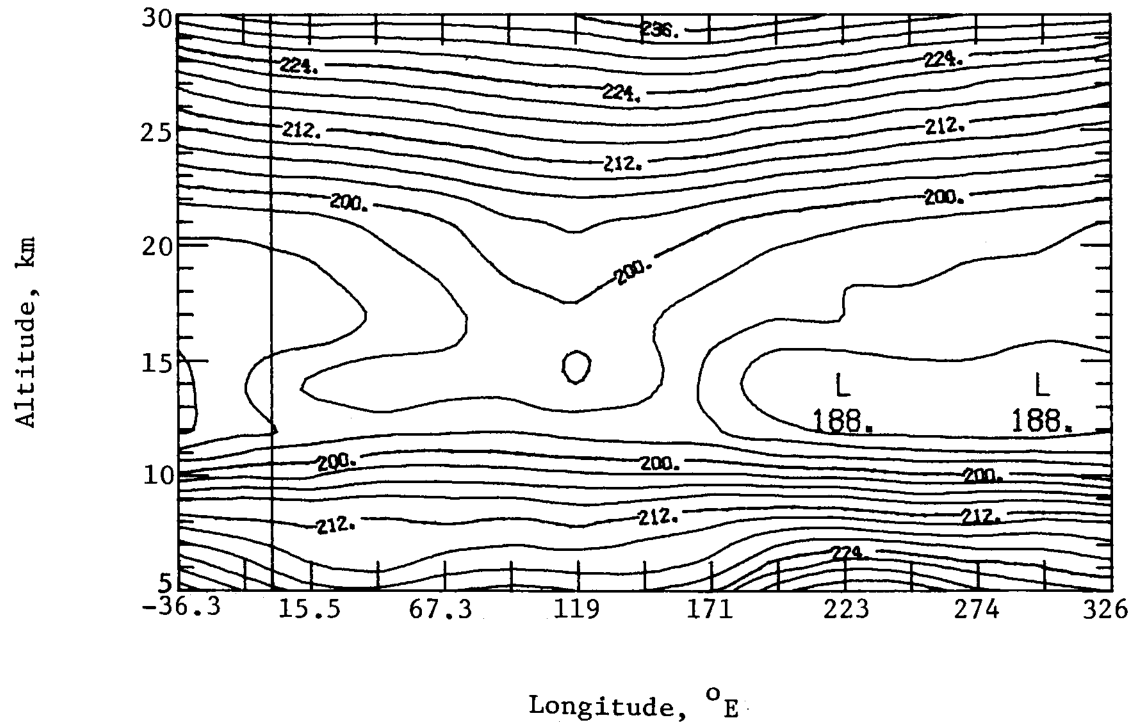


(b) Temperature contours.

Figure 58.- Antarctic extinction isopleth and temperature contours for September 14.88 to 15.90, 1982, at latitudes from 79.5° to 79.7° S corresponding to orbits 19 648 to 19 662.

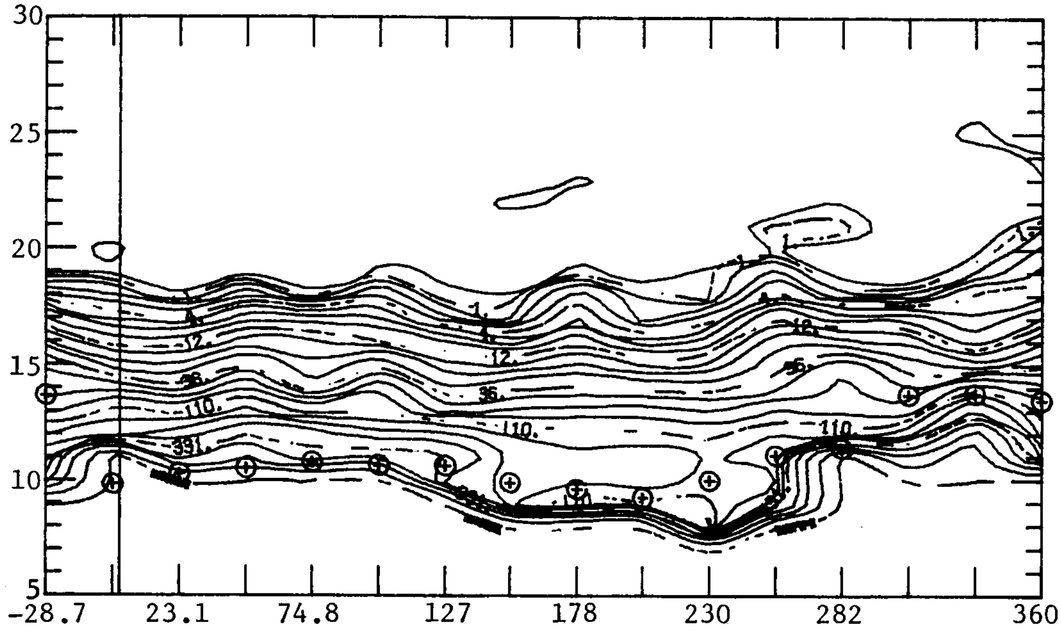


(a) Extinction isopleth.

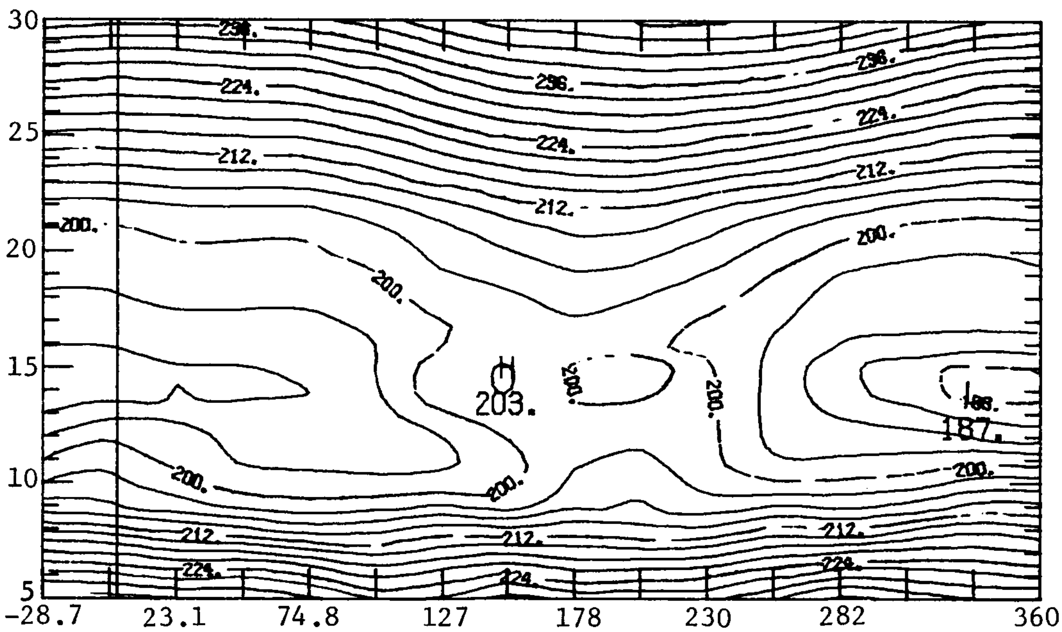


(b) Temperature contours.

Figure 59.- Antarctic extinction isopleth and temperature contours for September 22.84 to 23.85, 1982, at latitudes from 80.4° to 80.5° S corresponding to orbits 19 758 to 19 772.

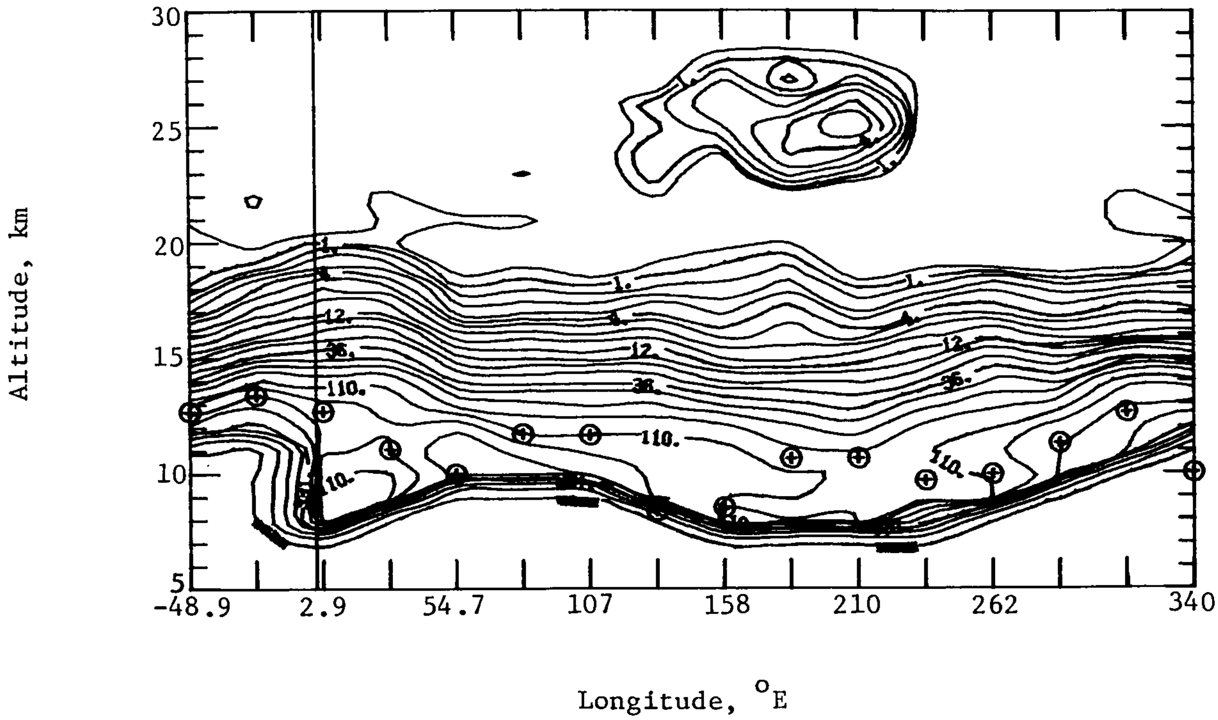


(a) Extinction isopleth.

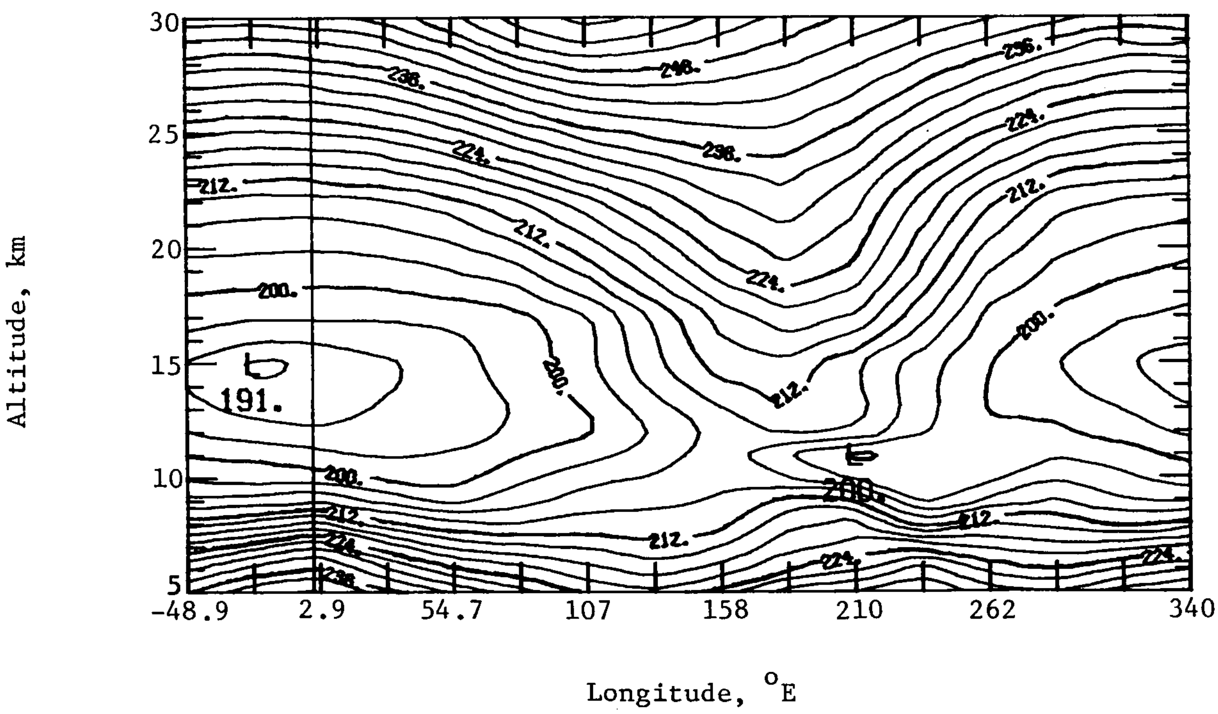


(b) Temperature contours.

Figure 60.- Antarctic extinction isopleth and temperature contours for September 30.80 to October 1.88, 1982, at a latitude of 80.5° S corresponding to orbits 19 868 to 19 883.

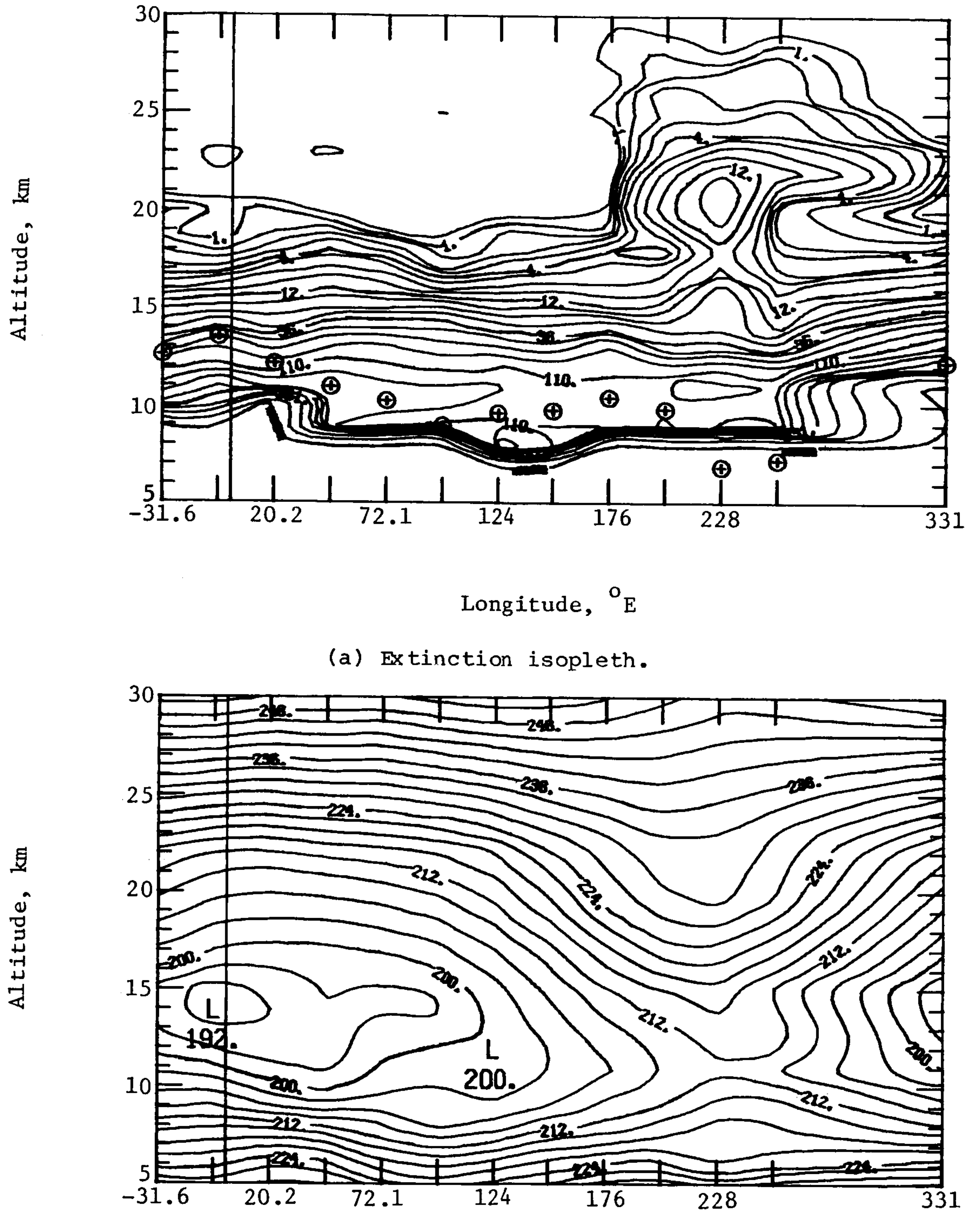


(a) Extinction isopleth.



(b) Temperature contours.

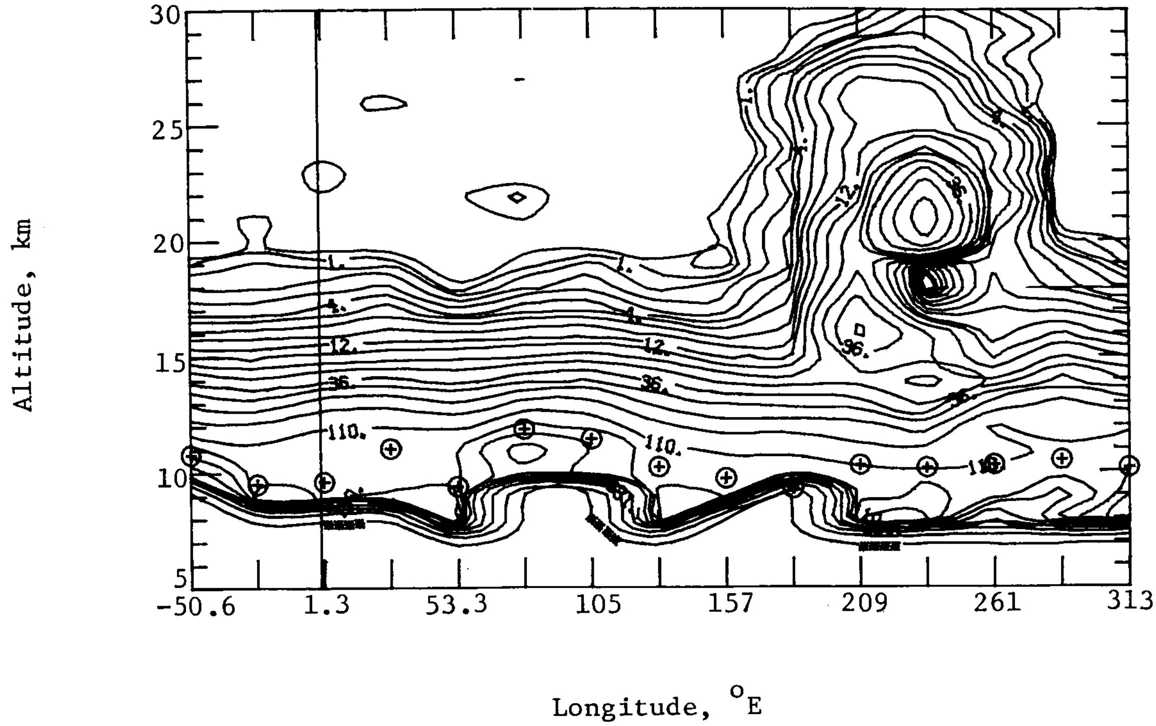
Figure 61.- Antarctic extinction isopleth and temperature contours for October 8.90 to 9.98, 1982, at latitudes from 79.6° to 79.5° S corresponding to orbits 19 980 to 19 995.



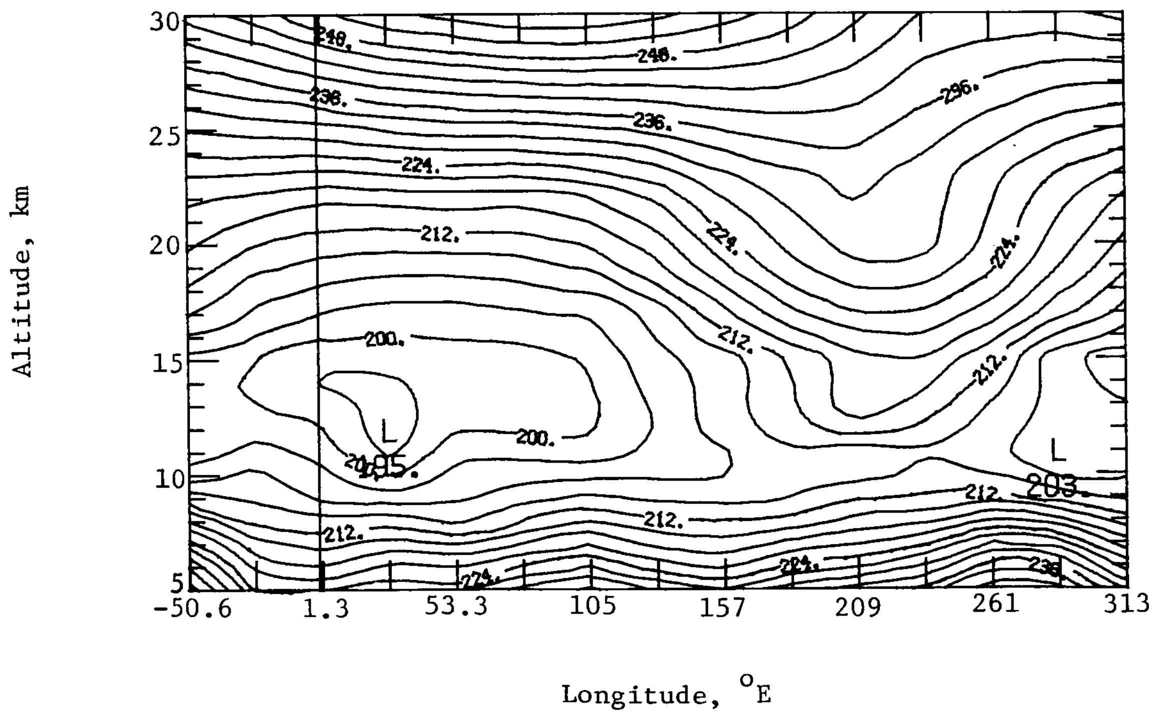
(a) Extinction isopleth.

(b) Temperature contours.

Figure 62.- Antarctic extinction isopleth and temperature contours for October 11.94 to 12.95, 1982, at latitudes from 79.1° to 78.9° S corresponding to orbits 20 022 to 20 036.

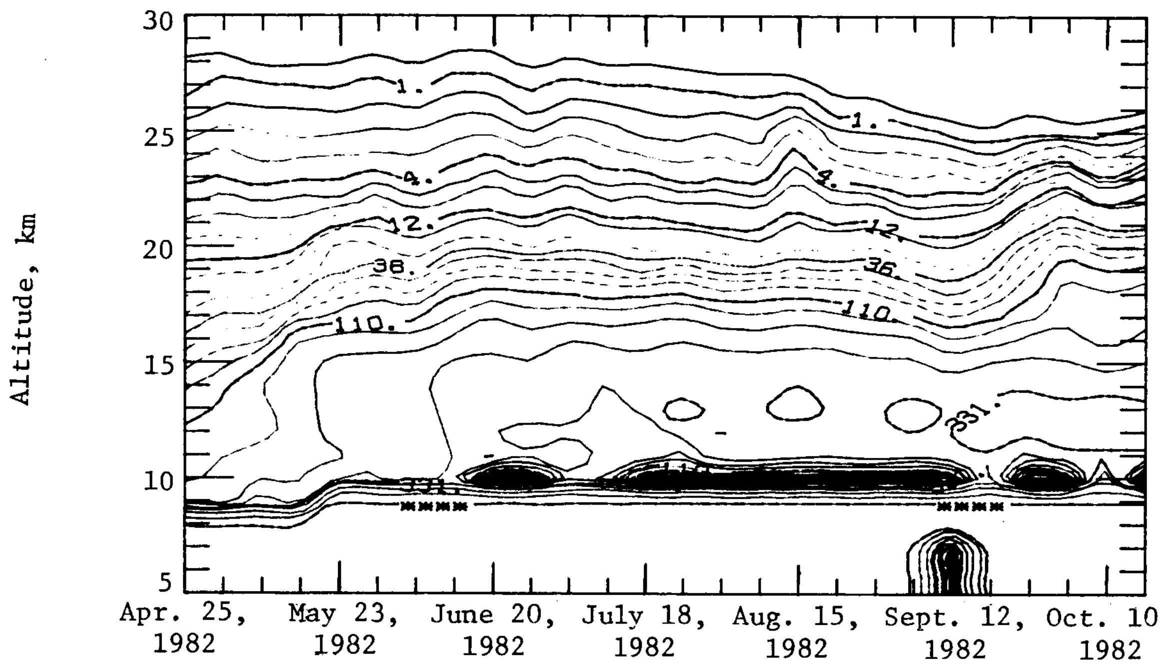


(a) Extinction isopleth.

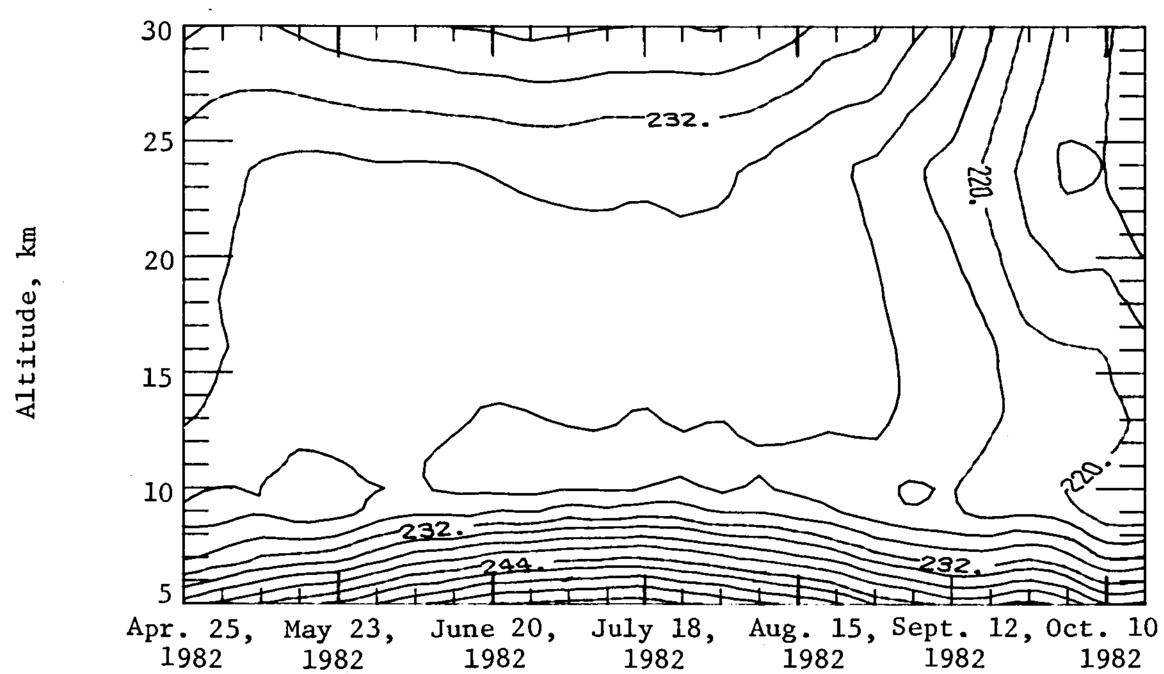


(b) Temperature contours.

Figure 63.- Antarctic extinction isopleth and temperature contours for October 18.01 to 19.03, 1982, at latitudes from 77.8° to 77.6° S corresponding to orbits 20 106 to 20 120.

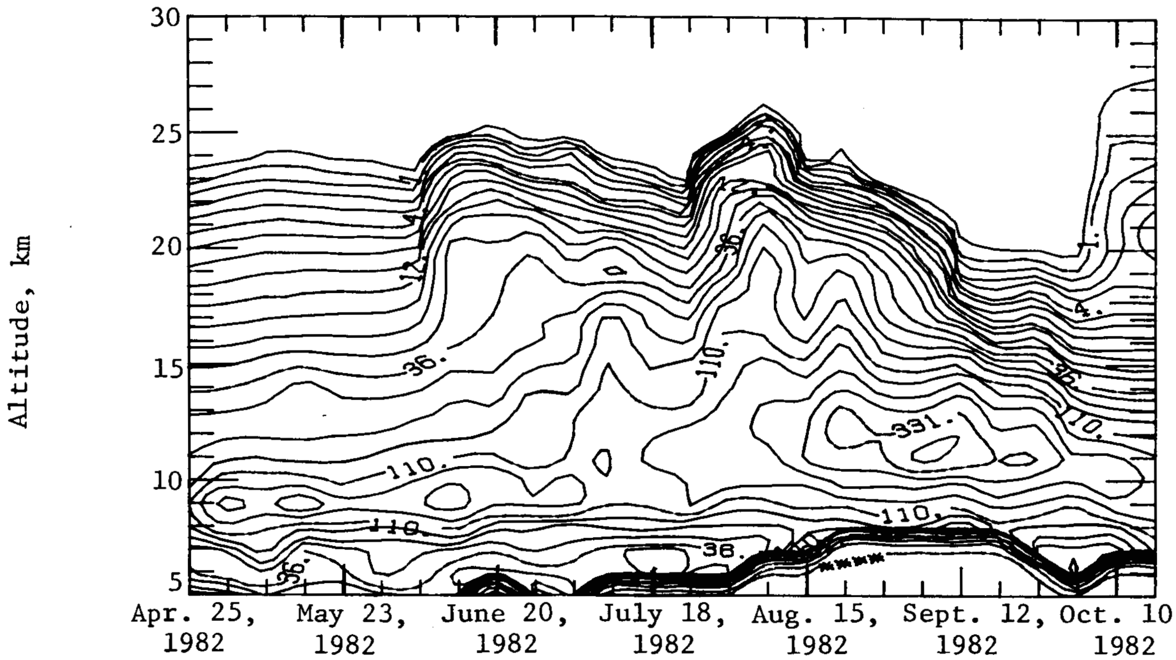


(a) Aerosol extinction at 1 μm in units of 10^{-5} km^{-1}.

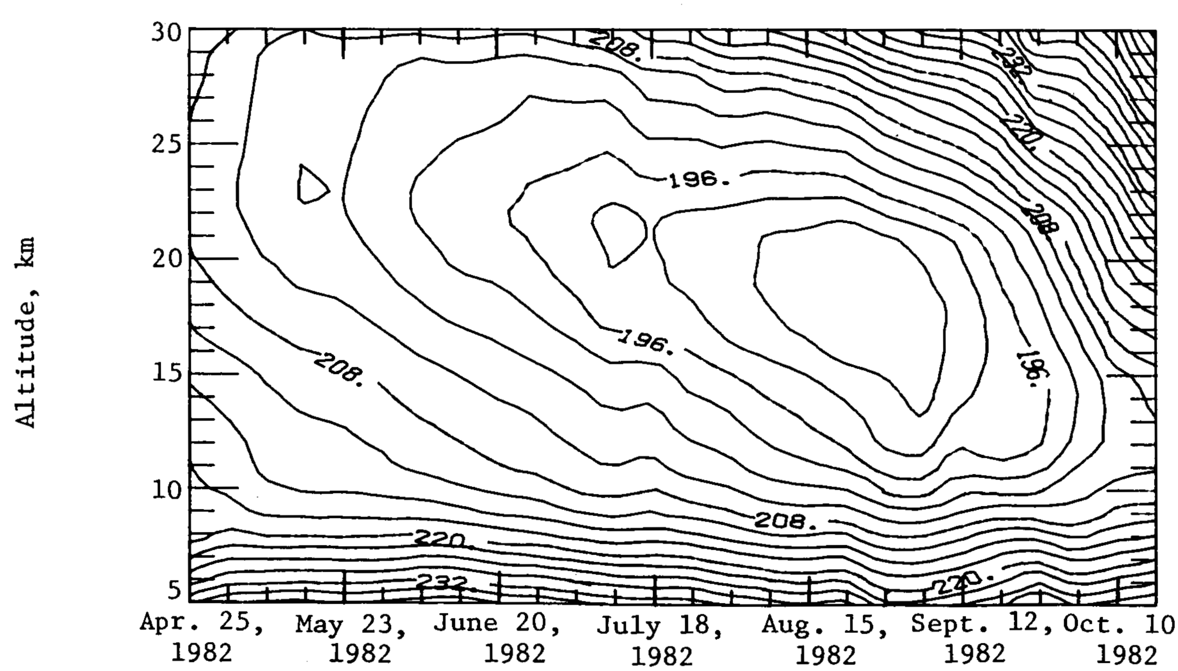


(b) Temperature field (kelvin) at location of aerosol measurement.

Figure 64.- Arctic extinction and temperature data showing weekly averaged values. The date marked on the horizontal axis is the first day of the week to which the average value corresponds.



(a) Aerosol extinction at 1 μm in units of 10^{-5} km^{-1}.



(b) Temperature field (kelvin) at location of aerosol measurement.

Figure 65.- Antarctic extinction and temperature data showing weekly averaged values. The date marked on the horizontal axis is the first day of the week to which the average value corresponds.

Standard Bibliographic Page

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16. Abstract

The Stratospheric Aerosol Measurement (SAM) II sensor aboard Nimbus 7 is providing extinction measurements of Antarctic and Arctic stratospheric aerosols with a vertical resolution of 1 km. Representative examples and weekly averages including corresponding temperature profiles provided by NOAA for the time and place of each SAM II measurement (Apr. 1982 - Oct. 1982) are presented. Contours of aerosol extinction as a function of altitude and longitude or time are plotted, and aerosol optical depths are calculated for each week. Typical values of aerosol extinction at 1.0 μm in the main stratospheric aerosol layer are approximately 4 to 6 times 10^{-4} km^{-1} at the beginning to 1 to 2 times 10^{-3} km^{-1} at the end of the time period for the Antarctic region and approximately 1 to 3 times 10^{-3} km^{-1} for the Arctic region throughout the time period. Stratospheric optical depths are about 0.002 to 0.009 for the Antarctic region and about 0.007 at the beginning to 0.024 at the end of the time period for the Arctic region. Polar stratospheric clouds were observed during the Antarctic winter, as expected. This report provides, in a ready-to-use format, a representative sample of the eighth 6 months of data to be used in atmospheric and climatic studies.

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